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NSP/004/127 - (OHI 27) Guidance on the Selection and Application of Insulators

1. Purpose

The purpose of this document is to provide guidance on the types of insulator or insulator assemblies to be installed on overhead lines up to and including 132kV on the Northern Powergrid Network.

This document supersedes the following documents, all copies of which should be destroyed:

Document Reference	Document Title	Version	Published Date
NSP/004/127	(OHI 27) Guidance on the selection and application of insulators	2.2	February 2010

2. Scope

This guidance note provides detailed information on the types and installation assemblies for insulators at various voltages. The contents are applicable up to and including 132kV overhead lines.

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3. Technical Specification

3.1 Background

The technical parameters for all new overhead line insulators are specified in NPS/001/006. This document is intended to provide guidance on the approved type of insulator or insulator assembly that should be utilised in specific overhead line situations.

3.2 Insulators

- All insulators used on new or refurbished overhead lines (up to and including 132kV wood pole and tower lines) shall be of composite construction unless specified otherwise.
- Pin type or LV Insulators shall be brown porcelain (except for 20kV and anti-vandal situation where they are grey composite insulators)
- Replacement insulators on existing overhead lines shall be the same colour as the existing insulators.
- When insulators are replaced in an existing tension string (or a complete assembly is replaced) they must have the same centres (or overall assembly length) as the insulators being replaced. Replacement of suspension insulators may utilise shorter string lengths.
- Failure to comply with the above requirements may compromise conductor line tension, ground clearances or overvoltage protection via arcing horn gaps.
- Where all insulator strings on a structure are being replaced i.e., during refurbishment, the insulator selection shall be as applicable for new overhead lines.
- Insulators on suspension sets and in downleads shall be anti-fog type unless they are modern composite units.
- All 11kV earthed poles shall incorporate 2-disc insulators or their composite equivalent.

3.2.1 Insulator Selection

The following table provides an index to the approved insulator types for use in each construction arrangement arranged by line voltage.

Construction Type	Specification Ref	Appendix No.
11kV Construction	NSP/004/042 & NSP/004/044	1
20kV Construction		2
33kV Construction	NSP/004/042 & CE/C/37*	3
66kV Construction - Historical	CE/C/37* & OHL4*	4
66/132kV Construction	NSP/004/045	5
66/132KV Steel Mast & Tower Lines	Various*	6
LV, Stay Insulators & Triggered Spark Gaps	Various*	7

Note:

*NGC and CE specifications may be no longer available in Northern PowerGrid database.

3.2.2 Composite Insulators and Torsional failures

Composite insulators have been designed to be extremely strong under tensile loading conditions however tests have shown that they offer very limited abilities to withstand twisting or torsional loadings.

All line staff including contractors must be made aware that composite insulators cannot withstand being subjected to twisting forces. Where it is necessary to rotate the conductor end fittings, this must be

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carried out with the insulator in a non-tension loaded condition. I.e., while the tensioning equipment still holds the conductor load.

3.2.3 Anti Vandal Prone Area's

The design of composite insulators provides them with inherent anti-vandal properties.

Where individual disc insulators are found damaged which are a component part of a multi disc assembly, consideration shall be given to the replacement of the complete insulator assembly with a modern composite insulator rather than the like for like replacement of the single disc.

3.3 Live Line Sections

Where live line sections points are required in 11-33kV wood pole lines they shall be formed through the installation of ball/ball 2, 3 or 4 disc equivalent composite insulators. Drawing no 1091010573 sht2 provides guidance on typical arrangements. Where it has been identified that a live line section point is likely to be used frequently as a point of isolation and in all cases adjacent to new PMAR installations, the section point shall be formed through the use of in-line isolators as shown on drawing 1091010752.

It is no longer permissible to create live line section points by cutting jumpers bows on section poles.

3.4 Triggered Spark gap Installations

For details on the installation requirements for triggered spark gaps see drawing no. 1091200014

3.5 OHL9 / OHL10 – (66-132kV) Wood Pole constructions or Woodhouse line replacements

Where new or diverted sections of 66/132kV overhead lines are constructed to the company's new design standards NSP/004/045 (Note: The previous NSP/004/046 had been merged with the existing NSP/004/045). It shall be noted that these constructions have been designed using a harmonised range of 132kV rated insulators.

As a consequence, where a line is operated at a lower system voltage than 132kV care shall be taken to ensure that the correct insulation coordination is applied to insulators located in approach zones or earthed positions. I.e., the correct range of arcing horn gap shall be applied.

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3.6 Tension and Suspension Insulator Assemblies

Wood Pole Lines				
Description of Insulator Assembly	Application Voltage	Historical Drawing Arrangements	New Drawing Arrangement	Appendix No
11/20 or 33kV Single Wood Pole Construction				
70kN Tension Insulator sets (43-40 construction)	11,20 & 33kV	1000439210 sht1	1000439210 sht2	8
70kN Live line section Insulator arrangements	11,20 & 33kV	1091010573 sht1	1091010573 sht2	9
33/66 or 132kV Wood Pole Construction				
70kN Suspension Insulator set (CE/C37 construction or (OHL 4 Construction)	33 & 66 kV	Y204L0703 1091010488 sht1	1091010488 sht6	10
70kN Tension Insulator set (CE/C37 construction or OHL 4 Construction)	33 & 66 kV	Y204L0704 1091010488 sht2	1091010488 sht9	11
70kN Tension Insulator set OHL 4 Construction)	66 kV	1091010488 sht2	1091010488 sht8	12
120kN -132kV Unearthed Pole Assembly (OHL 9 & OHL10)	66 & 132 kV		1091010487sht16, 18 & 30	13
120kN -132kV Earthed Pole Assembly (OHL 9 & OHL10)	66 & 132 kV		1091010487sht33,32 and 31	14

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Tower Lines				
Description of Insulator Assembly	Application Voltage	Historical Drawing Arrangements	New Drawing Arrangement	Appendix No
70kN Suspension Insulator Set	66/132kV	Y707L0704 / 1091010428 sht1 1091010488 sht1	1091010428 Sht7	15
120kN Tension Insulator Set	66/132kV	Y707L0701 / 1091010428 sht2	1091010428 sht8	16
70kN Inverted & Upright Low Duty Insulator Set	66/132kV	Y707L0706 / 1091010428 sht3 1091010488 sht3	1091010428 sht9	17
120kN Tension Insulator Set (Twin Conductor)	132kV	Y707L0702	1091010428 sht10	18
120kN Suspension Insulator Set (Twin Conductor)	132kV	Y707L0705	1091010428 sht11	19
120kN Inverted & Upright Low Duty Insulator Set	132kV	Y707L0707	1091010428 sht12	20
190kN Tension Insulator Set	132kV	Y707L0703	1091010428 sht13	21

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3.7 Associated insulator assembly fittings

Ball hooks, socket thimbles, etc used to form the above insulator assemblies shall comply with the requirements of NPS/001/005.

3.8 Sag Adjusters – EHV

Sag adjusters shall comply with NPS/001/005.

Sag adjusters should be fitted on all new EHV lines. Their purpose being to regulate sags or align insulator strings on twin insulator sets.

To align insulator strings, additional sag adjuster links should be inserted as necessary in one string and the sag adjusters should initially be set to equal amounts either side of the mid-range setting ‘DO’. A minimum of one sag adjuster link is required in each string. On existing lines, a maximum difference in alignment of half an insulator unit centre is permissible.

On single conductor lines the sag adjusters should initially be set as shown on drawing Y707L0701

Drawing Y707L0708 shows sag adjuster setting details for twin conductors.

3.9 Arcing Horns (Insulator Protective Devices) Applied to EHV Lines

Arcing horns are designed to:

- a) Shall effectively protect the insulator units and the fittings from damage from power arcs
- b) Shall effectively improve the voltage distribution along the insulator string
- c) Shall effectively improve the corona performance of the insulator set
- d) Shall effectively inhibit the formation of dry band arcing on composite insulators adjacent to end fittings.

Additionally, by varying the design of the arcing horn arrangement or insulator gap they can be used to promote the flashover of induced lightning over-voltages before the damaging overvoltage reaches key structures.

For the first 1.6km (1 mile) from a substation or from sealing ends terminating an underground cable that is directly connected to a substation, the arc gaps on tension and suspension sets shall be as detailed for the approach set.

Note: - EHV Wood pole lines shall incorporate earthed structures in the approach zone to promote the flashover of induced lightning over-voltages.

Standard Insulator sets				
Voltage	Approach Set (First 1.6km)		Normal Set	
	Non-Composite Strings	Composite Strings	Non-Composite Strings	Composite Strings
132 kV	1000mm (39")	1000mm	1120mm (23.5")	1175mm
66 kV	453mm (18")	440mm	570mm (22.5")	540mm
33 kV	* Not Required	* Not Required	* Not Required	Not Required

Note: - lab tests have shown that composite insulators have a lower electrical withstand breakdown than traditional ceramic insulators. For example, a traditional beyond gap of 1120mm breaks down at approx. 620kV instead of 650kV and a 453mm approach gap on 66kV sets needs to be reduced to 440mm to achieve a 325kV electrical withstand.

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132kV Reduced clearance suspension strings based on 9 x 140mm discs				
Voltage	Approach Set (First 1.6km)		Normal Set	
	Non-Composite Strings	Composite Strings	Non-Composite Strings	Composite Strings
132 kV	851mm (provides a calculated impulse value of 555kV)	925mm	851mm min	1025mm (provides a calculated impulse value of 565kV)

*** It is assumed that surge arrestors will always be installed on 33kV Cable terminations

Where 275kV or 400kV lines are operated at 132kV, extended arcing horns shall be used for the first 1.6km from substations or sealing ends to obtain a 1000mm arc gap.

3.10 Downloads and Slack Spans (EHV Lines)

Slack spans and down leads to structures and sealing end platforms or anchor blocks shall be erected with a maximum working tension of 4.5kN (1000lbf).

The bottom end of the down leads to anchor blocks shall be connected to earth using green PVC covered 70sq.mm copper conductor. A lug on one end of the conductor shall be cleated to the down lead and a lug on the other end of the conductor bolted to the substation earth tape.

3.10.1 Downlead clearances

The minimum clearance between downleads shall normally be 2.5m. In special cases this may be reduced to 1.5m for 132kV or 1.1m for 66kV under conditions of maximum sag and opposing conductor swing of adjacent phases.

Note these figures are enhanced values, See EN 50341—1 clause 5.5.3 and ENA TS 43-125 Part 1 clause 3.4.6.2 for further details.

Min clearance from top of anchor block to:

- Earth lug on inverted set 2.4m
- Lowest live metal on inverted set 3.8m

3.11 Post insulators located on Substation support Structures

Post Insulators required for use on substation support structures shall be specified to be in accordance with the Northern Powergrid specification NPS/003/015.

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4. References

4.1 External Documentation

Reference	Title
BS 3288-2	Insulator and conductor fittings for overhead power lines. Specification for a range of insulator fittings
BS EN 50341-1	Overhead electrical lines exceeding AC 1 kV. General requirements. Common specifications
ENA TS 43-102	Insulators and fittings for 132kV Lines
ENA TS 43-125	Design Guide and Technical Specification for Overhead Lines above 45kV.
ENA TS 43-40	“High Voltage Single Circuit Overhead Line on Wood Poles”
ENA TS 43-93	Technical specification for line insulators

4.2 Internal Documentation

Reference	Title
CE/C/37(M) and CE/OM/DC1(M)	“Specification for Yorkshire Electricity Overhead Lines to CE/C/37(M) and CE/OM/DC1(M)” – 33 & 66kV Portal construction with span lengths up to 150m
NPS/001/005	Technical Specification for Overhead Line Steelwork, Conductor Fittings, Insulator Fittings and Stay Fittings
NPS/001/006	Technical specification for insulators for overhead lines up to and including 132kV.
NPS/003/015	Technical Specification for 33kV, 66kV and 132kV Post Insulators
NSP/004/042	Specification for HV Wood Pole Lines up to and including 33kV
NSP/004/044	Specification for HV Wood Pole Lines of Compact Covered Construction up to and including 33kV
NSP/004/045	Code of Practice for EHV Wood Pole Lines operating up to 132kV with span lengths up to 220m

4.3 Amendments from Previous Version

Reference	Description
	Reference document and clause updated
	All Appendix cat no. drawings and descriptions updated

5. Definitions

Term	Definition
PMAR	Pole Mounted Auto Recloser

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6. Authority for Issue

6.1 CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Deb Dovinson	Governance Administrator	26/03/2024

6.1 Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period:

Standard CDS review of 3 years?	Non-Standard Review Period & Reason	
Yes	Period: n/a	Reason: n/a
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Aaron Chung	Policy and Standards Engineer	02/04/2024

6.2 Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Ged Hammel	Senior Policy and Standards Engineer	27/03/2024
Steven Salkeld	Policy and Standards Engineer	02/07/2024

6.3 Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	22/05/2024

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Appendix 1

Insulator types to be applied in different situations

11 kV Lines		
Cat No.	Application	New Description or insulator type to be used
53833	43-40 Construction operating at 11/20kV Pin insulator (Earthed / Anti Vandal) Note. <i>To be used in earthed situations and areas prone to vandalism. Also, on XLPE covered lines earthed and unearthed construction.</i>	11/20kV Grey Composite Pin Suitable For all 11kV and 20kV Applications Earthed and Un-Earthed: 70kV Wet Withstand, 78mm Neck & 25mm Groove To drawing 109.101.0486 Sht.13
253706	43-40 Construction operating at 11/20kV Tension Insulators (Anti Vandal Properties) Note. <i>To be used at both section and terminal poles on earthed construction.</i>	11kV and 20kV - 70kN Composite Tension: 70kV Wet Flashover: (2 x 140mm spacing) 16mm Ball/Socket End Fitting. To drawing 109.101.0487 sht. 24
216135	43-40 Construction operating at 11kV Tension Insulator (Anti Vandal Properties) Live Line Sections.	11kV, 70kN Composite Flying Section Insulator, 45kV Wet Withstand (2 x 140mm Porcelain Disc Equivalent) 16mm ball/ball end fitting. To drawing 109.101.0485 sht. 10
	Traditional Single 70kN Glass or Porcelain Disc Insulators – retained for single disc replacement etc	
250529	To be used only in emergency fault replacement situations – Note. One disc for un-earthed and two discs for earthed construction. Also, two discs used at live line sections.	Glass Disc Insulator 254mm x 140mm, 70kN MFL To drawing 109.101.0484 sht. 2

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Appendix 2

20kV Lines		
Cat No.	Application	New Description or insulator type to be used
253777	43-40 Construction operating at 20kV Pin insulator Note. <i>Standard Pin for un-earthed construction</i>	11/20kV Brown Porcelain Pin Insulator, 50kV Wet Withstand, 78mm neck & 25mm Groove. To drawing 109.101.0486 sht. 11
253833	43-40 Construction operating at 11/20kV Pin insulator (Earthed / Anti Vandal) Note. <i>To be used in earthed situations and areas prone to vandalism. Also, on XLPE covered lines earthed and unearthed construction.</i>	11/20kV Grey Composite Pin Suitable For all 11kV and 20kV Applications Earthed and Un-Earthed: 70kV Wet Withstand, 78mm Neck & 25mm Groove To drawing 109.101.0486 Sht.13
253706	43-40 Construction operating at 11/20kV Tension Insulators (Anti Vandal Properties) Note. <i>To be used at both section and terminal poles on earthed construction.</i>	11kV and 20kV - 70kN Composite Tension: 70kV Wet Flashover: (2 x 140mm spacing) 16mm Ball/Socket End Fitting. To drawing 109.101.0487 sht. 24
247412	43-40 Construction operating at 20kV – Tension Insulator – Live Line Sections (Anti Vandal Properties)	Insulator, 20kV, 70kN Composite Flying Section Insulator 70kV Wet Withstand (3 Porcelain Disc Equivalents) 16mm ball/ball end fittings. To drawing 109.101.0485 sht. 11
	Traditional Single 70kN Glass or Porcelain Disc Insulators – retained for single disc replacement etc	
250529	To be used only in emergency fault replacement situations Note. <i>With two discs for un-earthed and earthed construction. Also, three discs used at live line sections.</i>	Glass Disc Insulator 254mm x 140mm, 70kN MFL. To drawing 109.101.0484 sht. 2

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Appendix 3

33kV Lines		
43-40 Construction		
Cat No.	Application	New Description or insulator type to be used
253423	43-40 Construction operating at 33kV Pin insulator / Anti Vandal Insulator Note. <i>Used on earthed and un-earthed poles and areas prone to vandalism and on all XLPE lines.</i>	33kV Brown Porcelain Pin Insulator, 90kV Wet Withstand, 120mm neck & 25mm Groove. To drawing 109.10100486 Sht. 4
216150	43-40 Construction operating at 33kV Tension Insulators (Anti Vandal Properties) Note. <i>To be used at both section and terminal poles, earthed and un-earthed construction.</i>	33kV, 70kN Composite Tension Insulator, 90kV Wet Withstand (3 Porcelain Disk Equiv) 16mm ball/socket end Fittings. To drawing 109.101.0487 sht. 23
Traditional Single 70kN Glass or Porcelain Disc Insulators – retained for single disc replacement or Live Line Sections		
250529	43-40 Construction operating at 33kV Live Line Sections (4 discs normally used)	Glass Disc Insulator 254mm x 140mm, 70kN MFL. To drawing 109.101.0484 sht. 2
<u>CE/C/37 – 33kV</u>		
216150	CE/C/37 Construction operating at 33kV 70kN Suspension assembly to Dgn.Y204L0703 Note. <u>Existing arrangement</u> <i>3 x 140mm disc insulator strings (Assembly length 413mm)</i>	33kV, 70kN Composite Suspension Insulator. 90kV Wet Withstand (3 x 140mm Porcelain Disk Equiv) 16mm ball/socket end fittings. See arrangement drawing 1091010488 sht6 and 1091010487 sht23
251546	CE/C/37 Construction operating at 33kV 125kN Tension assembly to Dgn.Y204L0704 Note. <u>Existing arrangement</u> <i>Unearthed Const. - 3 x 178mm disk insulators strings (assembly length 534mm)</i>	33kV, 120kN Composite Tension Insulator, 90kV Wet Withstand (3 x 178mm Porcelain Disk Equiv) 20mm ball/socket end fittings See arrangement drawing 1091010488 sht9.
216218	CE/C/37 Construction operating at 33kV 125kN Tension assembly to Dgn.Y204L0704 Note. <u>Existing arrangement</u> <i>Earthed Const 4 x 178mm disc insulators (assembly length 712mm)</i>	33kV, 120kN: Composite Tension / Suspension 125kV Wet Flashover (4 x Porcelain Disc Equivalent) 20mm ball/socket end fittings. See arrangement drawing 1091010487 sht27.

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Appendix 4

66kV Lines		
OHL4 Wood Pole Construction		
Cat No.	Application	New Description or insulator type to be used
Approach 251542	OHL4 Construction operating at 66kV Suspension assembly to Drawing 109.123.1190 <u>Note</u>	66kV Composite Suspension Insulator Assembly, 70kN (Equivalent to 5 X Porcelain 439306 discs) 16mm ball/socket end fittings. To drawing 109.101.0487 sht. 20
Non- Approach 251541	<u>Existing Arrangement</u> 5 x 140mm disc (Approach and Non-Approach) originally to 1091010485 – (70kN) (Assembly Length 700mm)	Supplied with arcing horns and preset gap for either approach or non-approach situations See Arrangement Drawing 1091010488 sht 6
Approach 251559	OHL4 Construction operating at 66kV –Tension Assembly to Drawing 109.123.1192 <u>Note.</u>	66kV Composite Tension Insulator Assembly, 70kN (Equivalent to 5 X Porcelain 439306 discs) 16mm ball/socket end fittings.
Non- Approach 251560	<u>Existing Arrangement</u> 5 x 140mm disc (Earthed & Unearthed) originally to 1091010484 sh2 (70/80KN) – Assembly length 700mm.	Supplied with arcing horns and preset gap for either approach or non-approach situations. See Arrangement Drawing 1091010488 sht 8
253703	OHL4 Construction operating at 66kV Post Insulators used on centre phase of intermediate and suspension arrangements. Formally to drawing 1091010589.	Insulator, 66kV Grey Composite Line Post with flange mounting (replacement for OHL4 Porcelain Post). 109.101.0589 sht13
66 KV DC Tower Lines		
Approach 251535	66kV Double Circuit Tower Lines 70kN Suspension assembly <u>Note.</u>	66kV Composite suspension Insulator Assembly, 70kN MFL (Equivalent to 5 x 140mm porcelain disks) 16mm ball/socket end fittings. To drawing 109.101.0487 sht. 20 and 109.101.0428 sht. 7
Non- Approach 251534	<u>Existing Arrangement</u> 5 x 140mm disc insulators to Drawing 1091010485 sht. 3 (Assembly length 700mm).	Supplied with arcing horns and preset gap for either approach or non-approach situations
Approach 251530	66kV Double Circuit Tower Lines 125kN Tension Assembly <u>Existing Arrangement</u>	66kV Composite Tension Insulator assembly, 120kN MFL, (Equivalent to 5 x 178mm porcelain disks) 20mm ball/socket end fittings. To drawing 109.101.0428 sht. 8
Non- Approach 251563	5 x 178mm disk insulators to Drawing to 1091010484 sht. 2 (Assembly length 890mm)	Supplied with arcing horns and preset gap for either approach or non-approach situations
251526	66kV Double Circuit tower lines 70kN MFL Low Duty Down lead Insulator assemblies. (5 x 178mm disc equivalent insulator strings)	66kV Low Duty Assembly for down leads - 70kN, 2 x (5 x 140mm spacing) with 16mm ball ended eye link and socket tongue fittings - 440mm arcing horn gap To drawing 109.101.0428 sht. 9

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66kV CE/C/37 (Wood pole Construction)		
Cat No.	Application	New Description or insulator type to be used
Approach 251542	CE/C/37 Construction operating at 66kV. 70kN Suspension assembly to Dgn.Y204L0703 <u>Existing Arrangement</u>	66kV Composite suspension Insulator Assembly, 70kN MFL (Equivalent to 5 x 140mm porcelain disks) 16mm ball/socket end fittings. To drawing 109.101.0487 sht. 20
Non- Approach 251541	5 x 140mm disc insulators (Earthed & Unearthed construction) Assembly length 700mm	Supplied with arcing horns and preset gap for either approach or non-approach situations. See arrangement drawing 1091010488 sht6
Approach 251539	CE/C/37 Construction operating at 66kV. 125kN Tension assembly to Dgn.Y204L0704)	66kV Composite Tension Insulator Assembly, 120kN MFL, (Equivalent to 5 x 178mm porcelain disks) 20mm ball/socket end fittings. To drawing 109.101.0428 sht. 7
Non- Approach 251536	<u>Existing Arrangement</u> 5 x 178mm disc equivalent (Earthed & Unearthed) Assembly length 890mm <u>Existing Arrangement</u> <i>6 x 178mm disc equivalent (Earthed & Unearthed) actual length 1068mm Used in parts of YEDL on ACSR lines</i>	Supplied with arcing horns and preset gap for either approach or non-approach situations. See arrangement drawing 1091010488 sht9.
Approach 251559	<i>Non – Standard</i> CE/C/37 Construction operating at 66kV. 70kN Tension assembly to Dgn.Y204L0704)	66kV Composite Tension Insulator Assembly, 70kN (Equivalent to 5 X Porcelain 439306 discs) 16mm Ball/Socket End Fittings.
Non- Approach 251560	Note. <u>Existing Arrangement</u> <i>6 x 178mm disc equivalent (Earthed & Unearthed) Assembly length 1068mm Used in parts of YEDL on historical copper lines</i>	Supplied with arcing horns and preset gap for either approach or non-approach situations See arrangement drawing 1091010488 sht8 and 109.101.0428 sht. 7
253702	CE/C/37 Construction operating at 66kV. Post Insulator to Dgn.Y104L0104 Note. <u>Existing Arrangement</u> Allied P11128 post insulator)	Insulator, 66kV Grey Composite Line Post complete with single 50mm Mounting Stud. Neck Dia 73mm, (Suitable for std 78mm helical fitting) Insulator drawing 109.101.0487 sht. 12

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Appendix 5

(OHL9 / OHL10) – 66/132kKV Wood Pole Construction		
Cat No.	Application	New Description or insulator type to be used
66 & 132kV Tension Assemblies		
251552	OHL9 / OHL10 Single Circuit Wood Pole Construction. 66/132kV, 125kN Tension Insulators – Unearthed/Non-Approach Locations	132kV Composite Tension Insulator Assembly, 120kN with 20mm Ball/Socket End Fittings and including arcing horns with (adjustable gap from 1175mm at 132kV to 540mm at 66kV). See drawing 1091010487 sht. 30
251553	OHL9 / OHL10 Single Circuit Wood Pole Construction – 132kV, 125kN Tension Insulators – Earthed/ Approach Locations	132kV Composite Tension Insulator Assembly, 120kN with 20mm Ball/Socket End Fittings and Including arcing horn assembly with gaps set at 1000mm for 132kV operation. See drawing 1091010487 sht. 31
251554	OHL9 / OHL10 Single Circuit Wood Pole Construction – 66kV, 125kN Tension Insulators – Earthed/ Approach Locations	132kV Composite Tension Insulator Assembly, 120kN with 20mm Ball/Socket End Fittings and including arcing horn assembly with gaps set at 440mm for 66kV operation. See drawing 1091010487 sht. 31
66 & 132kV Intermediate Assemblies		
251551 (Without Stool) or 251550 (With Stool)	OHL9 / OHL10 Single Circuit 66/132kV Wood Pole Construction. Standard Composite Vertical Post/Pilot insulators formally to drawing 109.101.0487 sht. 2 (Non-Approach Zone or Unearthed locations)	132kV Polymeric Vertical Post Insulators c/w with Clamp Adaptor and Trunnion designed for poplar conductor and inclusive of arcing horns to 109.101.0487 sht. 18. See notes on drawing relating to the use of a support stool and armour grip clamps on pilot insulator positions
346397	Arcing horn arrangement for the above arrangement located in an Approach Zone or earthed locations	Arcing horn kit for insulator arrangement shown on drawing 109.101.0487 sht. 18. but with arcing horns applied as shown on drawing 1091010487 sht. 32.
251548 OHL 10 – No base or 251549 OHL9 – c/w Base	OHL9 / OHL10 Single Circuit 66/132kV Wood Pole Construction. Standard Composite Horizontal Post insulator formally to drawing 109.101.0487 sht. 11 (Non-Approach Zone or Unearthed locations)	Insulator, 132kV Grey Composite Horizontal Post (OHL9 / OHL10 Spec) 109.101.0487 sht. 16 See notes on drawing relating to the use of bendable base
346398	Arcing horn arrangement for the above arrangement located in an Approach Zone or earthed locations	Arcing horn kit for insulator arrangement as shown on drawing 109.101.0487 sht. 16. but with arcing horns applied as shown on drawing 1091010487 sht. 33

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Appendix 6

<u>PB – Double Circuit Mast Line (Wormald Green)</u>		
Cat No.	Application	New Description or insulator type to be used
346416	Double Ct Steel Masts - For use on 132kV double circuit steel masts Standard Composite Vertical Post insulator to formally to drawing 109.101.0487 sht. 2	To be replaced with a composite assembly
-	Double Ct Steel Masts - For use on 132kV double circuit steel masts – Composite Horizontal Insulators (Earthed Structure) formally drawing 1091010487 sht. 8	To be replaced with a composite assembly
346647	Double Ct Steel Masts - For use on 132kV double circuit steel masts – Composite Horizontal (Special) Insulators formally drawing 1091010487 sht. 10	To be replaced with a composite assembly
-	Double Ct Steel Masts - For use on 132kV double circuit steel masts - Tension Insulators Formally drawing 109.101.0487 sht. 9	Double Ct Steel Masts - For use on 132kV double circuit steel masts - Tension Insulators Formally drawing 109.101.0487 sht. 29

132kV Lines (cont.)		
<u>Post Insulators on H Poles</u>		
346454	Composite Horizontal Post Insulator 132kv With Pedestal Base. Ref L522008-2105. Formally to Drawing 1.09.101.0487 Sht. 5	To be replaced with a composite assembly
-	Historical - NEDL Single circuit 132KV Wood Pole Construction – Intermediate Post Insulators on H Pole arrangement	To be replaced with a composite assembly

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Appendix 6 cont.

132kV Double circuit Tower lines (1 x175mm/200mm CSA conductor)		
Cat No.	Application	New Description or insulator type to be used
132kV Suspension Insulator Assemblies		
251533	132kV Double Circuit tower lines 70kN Suspension insulators using (11 x 140mm disc equivalent insulator strings) Located on Approach Towers	132kV Suspension Insulator Assembly 70kN, 11 x 140mm spacing, 16mm ball ended hook (15/32) and socket clevis fittings - 1000mm arcing horn gap designed for approach towers. Composite equivalent of 1091010428 sht7
251561	132kV Double Circuit tower lines 70kN Suspension insulators using (11 x 140mm disc equivalent insulator strings) Located on Non-Approach Towers	132kV Suspension Insulator Assembly 70kN, 11 x 140mm spacing, 16mm ball ended hook (15/32) and socket clevis fittings - 1175mm arcing horn gap designed for Non approach or normal towers. Composite equivalent of 1091010428 sht7
251562	132kV Double Circuit tower lines – Reduced Clearance strings for ground clearance issues. 70kN Suspension insulators using (9 x 140mm disc equivalent insulator strings) Located on Approach Towers	132kV Suspension Insulator Assembly - reduced clearance 70kN, 9 x 140mm spacing with 16mm ball ended hook (15/32) and socket clevis fittings - 925mm arcing gap designed for approach towers. Composite equivalent of 1091010428 sht7
251531	132kV Double Circuit tower lines – Reduced Clearance strings for ground clearance issues. 70kN Suspension insulators using (9 x 140mm disc equivalent insulator strings) Located on Non-Approach Towers	132kV Suspension Insulator Assembly - reduced clearance 70kN, 9 x 140mm spacing with 16mm ball ended hook (15/32) and socket clevis fittings – 1025mm arcing gap designed for non-approach or normal towers. Composite equivalent of 1091010428 sht7
132kV Tension Insulator Assemblies		
251528	132kV Double Circuit tower lines 125kN Tension insulators using (9 x 178mm disc equivalent insulator strings) Located on Approach Towers	132kV Tension Insulator Assembly (120kN) based on 9 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue with 1000mm arc gap designed for approach towers. Composite equivalent of 1091010428 sht8
251564	132kV Double Circuit tower lines 125kN Tension insulators using (9 x 178mm disc equivalent insulator strings) Located on Non-Approach Towers	132kV Tension Insulator Assembly (120kN) based on 9 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue with 1175mm arc gap designed for Non approach towers. Composite equivalent of 1091010428 sht8
132kV Low Duty Down leads		
251525	132kV Double Circuit tower lines 70kN Low Duty Down lead insulator assemblies using (9 x 178mm disc equivalent insulator strings)	132kV Low Duty Assembly for down leads - 70kN, 2 x (11 x 140mm spacing) with 16mm ball ended eye link and socket tongue fittings - 1000mm arcing horn gap Composite equivalent of 1091010428 sht9

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Appendix 6 cont.

(132kV Double Circuit Tower Lines – 2 x Lynx or single large conductor)		
Cat No.	Application	New Description or insulator type to be used
251524	132kV Double Circuit tower lines (Twin 175mm Conductors) - 125kN Tension insulators using 9 x 171mm disc equivalent insulator strings located on Approach Towers	132kV Tension Insulator Assembly (120kN) 20mm ball ended eye link fitting and socket tongue based on 2 off 9 x 178mm spacing assemblies with 1000mm gap on approach towers. Composite version of 1091010428 sht. 10
251523	132kV Double Circuit tower lines (Twin 175mm Conductors) - 125kN Tension insulators using 9 x 171mm disc equivalent insulator strings located on Non-Approach Towers	132kV Tension Insulator Assembly (120kN) 20mm ball ended eye link fitting and socket tongue based on 2 off 9 x 178mm spacing assemblies with 1175mm gap on non-approach towers. Composite version of 1091010428 sht. 10
251522	132kV Double Circuit tower lines (Twin 175mm Conductors) - 125kN MFL Suspension Insulators using 11 x 171mm disc equivalent insulator strings located on Approach Towers	132kV Suspension Insulator Assembly (125kN) 11 x 171mm spacing with 1000mm arc gap on approach towers. Composite version of 1091010428 sht. 11
251521	132kV Double Circuit tower lines (Twin 175mm Conductors) - 125kN Suspension insulators using 11 x 171mm disc equivalent insulator strings located on Approach Towers	132kV Suspension Insulator Assembly (125kN) 11 x 171mm spacing with 1175mm arc gap on Non-Approach Towers. Composite version of 1091010428 sht. 11
251520	132kV Double Circuit tower lines 125kN MFL Low Duty Down lead insulator assemblies. 2 off 9 x 171mm disc equivalent insulator strings	132kV Low Duty Insulator Assembly for 120kN down leads - To include both Upright and Inverted insulator assemblies, 1000mm arc gap. Composite version of 1091010428 sht. 12

132kV Double circuit Tower lines (300mm or 400mm CSA conductor)		
251519	132kV Double Circuit tower lines (Single Large conductor 190kN rating) - 190kN MFL Tension Insulators. 9 x 178mm disc equivalent insulator string Approach Construction	132kV Tension Insulator Assembly – (Single large Conductor 190kN) based on 9 x 178mm spacing with 1000mm gap on approach towers. Composite version of 1091010428 sht13
251565	132kV Double Circuit tower lines (Single Large conductor 190kN rating) - 190kN MFL Tension Insulators. 9 x 178mm disc equivalent insulator string Non-Approach Construction	132kV Tension Assembly – (Single large Conductor 190kN) based on 9 x 178mm spacing with 1175mm gap on non-approach towers. Composite version of 1091010428 sht13

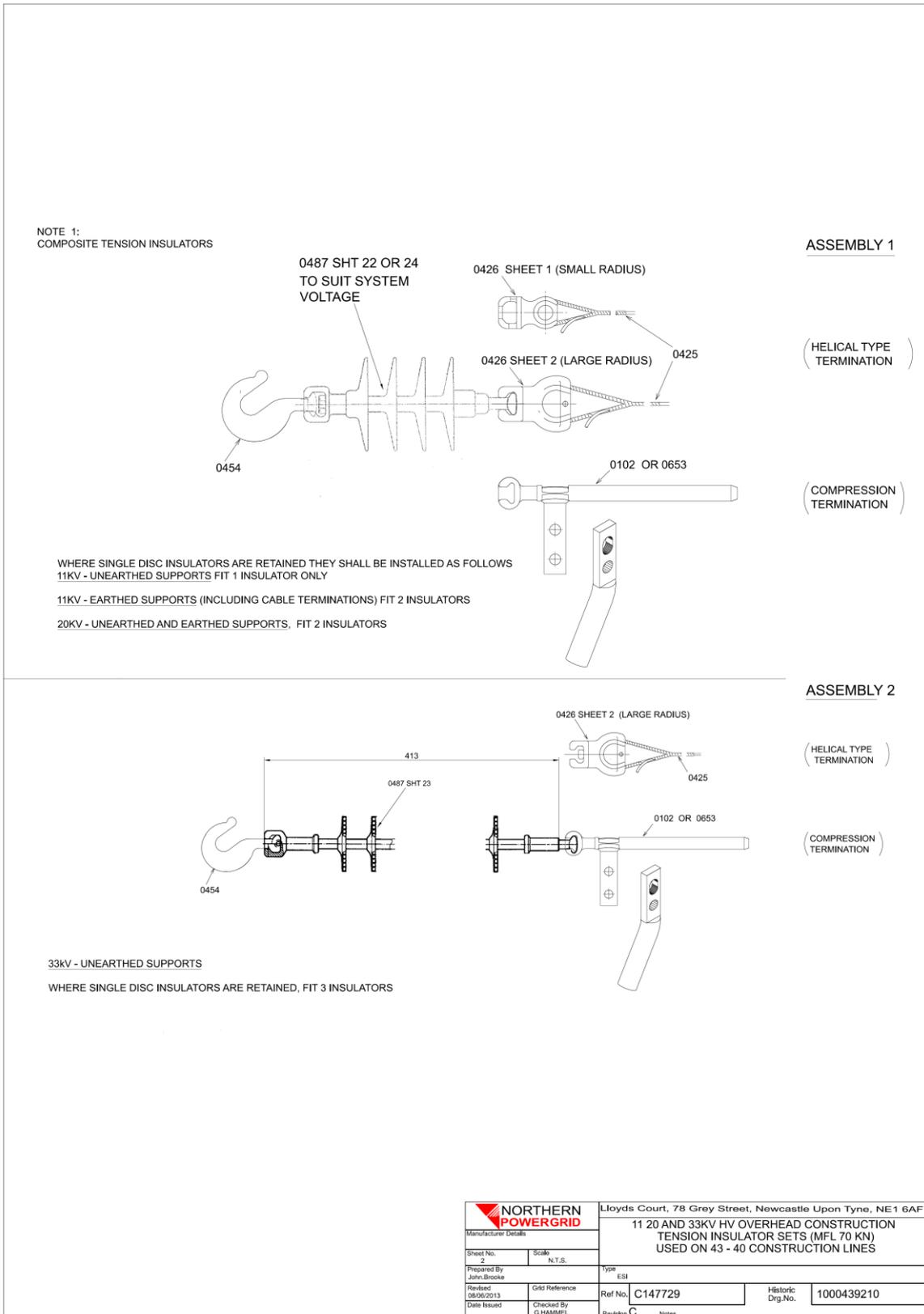
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Appendix 7

Stay Insulators		
Cat No.	Application	New Description or insulator type to be used
248232	For use on low voltage, 11kV and 20kV un-earthed and earthed systems	Insulator, Stay Porcelain Type 1, ESI 43-91 & Drawing No: 1.00.043.9107 sht1, item 1.
253743	For use on 33 and 66kV earthed systems	Insulator, Stay Porcelain Type 2, ESI 43-91 & Drawing No: 1.00.043.9107 sht1, item 2
251547	For use on 66kV or 132kV unearthed supports	Composite Stay Insulator 66/132kV inclusive of arcing horns. See drawing 1091010372 sht2 item 1
346596	For use on 66kV reduced length unearthed supports	Composite Stay insulator for 66kV reduced length Unearthed wood poles structures. See drawing 1091010372 sht2 item 2
LV Insulators		
253917	LV Reel Insulators For use on LV poles and service brackets at steel poles and buildings	Insulator, LV Reel, Brown Porcelain to 1000439304 sht2
253866	Coach Screw Insulators For service attachments to wood poles	Insulator, Coach Screw service, Brown Porcelain to 1000439305
Outdoor Cable Termination Stand-off Insulators		
170998	Insulator for use on 11kV pole mounted stand off cable termination's	Insulators, 11kV Outdoor Cable Termination Stand-off Type, (Set of 3) 1091010486 sht 20
171079	Insulator for use on 20kV pole mounted stand off cable termination's	Insulators, 20kV Outdoor Cable Termination Stand-off Type, (Set of 3) 1091010486 sht 21
085142	Insulator for use on 33kV pole mounted stand off cable termination's	Insulators, 33kV Outdoor Cable Termination Stand-off Type (Set of 3) 1091010486 sht 22
Spark Gaps		
242471	11kV lines	Triggered Spark Gap Assembly, 11kV 1091010339 sht1
242537	20 and 33kV lines	Triggered Spark Gap Assembly, 20 & 33kV 1091010339 sht2

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Appendix 8



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Appendix 8a

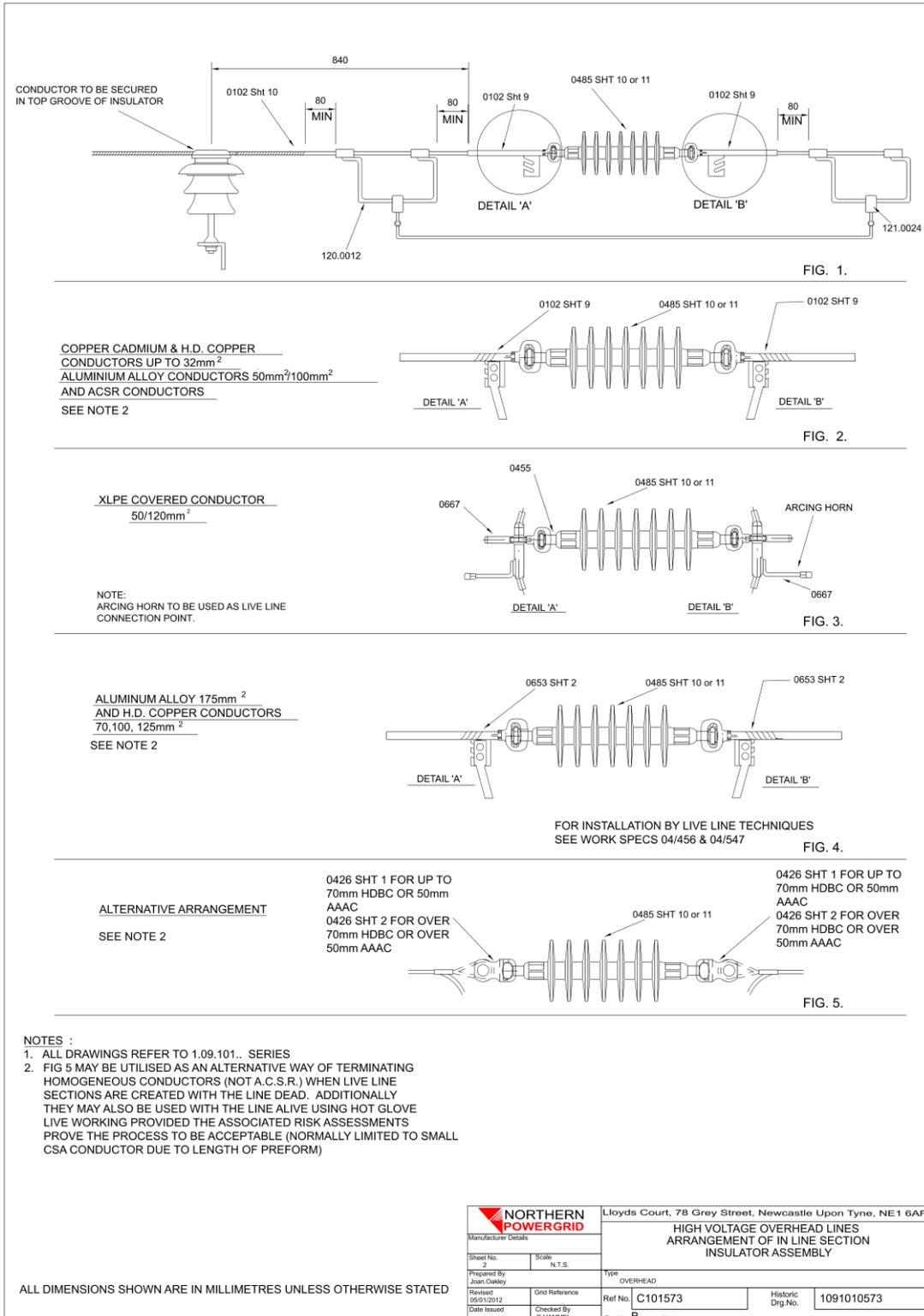
Materials List for drawing 1000439210 sht2

Assembly 1 – 11/20kV Tension Insulator Assembly					
Item No.	No.	Stock Cat No.	Description	drawing no.	BS 3288 Part 2
1	1	253071	70kN Ball ended Hook	1091010454	Fig 12, Ref 15/81
2	1	253695 (Obsoleted)	Insulator, 11kV, 70kN Composite Tension. 50kV Wet Flashover (2 Disk Equiv)	1091010487 sht22	n/a
			Or		
2	1	253706	Insulator, 11/20kV, 70kN Composite Tension. 70kV Wet Flashover (2 Disk Equiv)	1091010487 sht24	n/a
3	1	264682	70kN Small Radius Socket Thimble (Limited to Cond CSA <= 70mm)	1091010426 Sht1	n/a
			or		
3	1	264610	70kN Large Radius Socket Thimble (Cond CSA > 70mm)	1091010426 Sht3	n/a
			or		
3	1	To Suit	Compression Dead End c/w slotted palm	1091010102 sht9	n/a

Assembly 2 – 33kV Tension Insulator Assembly – Earthed & Unearthed 43-40 Construction					
Item No.	No.	Stock Cat No.	Description	CE Detailed drawing no.	BS 3288 Part 2
1	1	253071	70kN Ball ended Hook	1091010454	Fig 12, Ref 15/81
2	1	216150	Insulator, 33kV, 70kN Composite Tension/Suspension. 90kV Wet Flashover (3 Disk Equiv)	1091010487 sht23	n/a
3	1	264610	70kN Large Radius Socket Thimble (Cond CSA > 70mm)	1091010426 Sht3	n/a
			or		
3	1	To Suit	Compression Dead End c/w slotted palm	1091010102 sht9	n/a

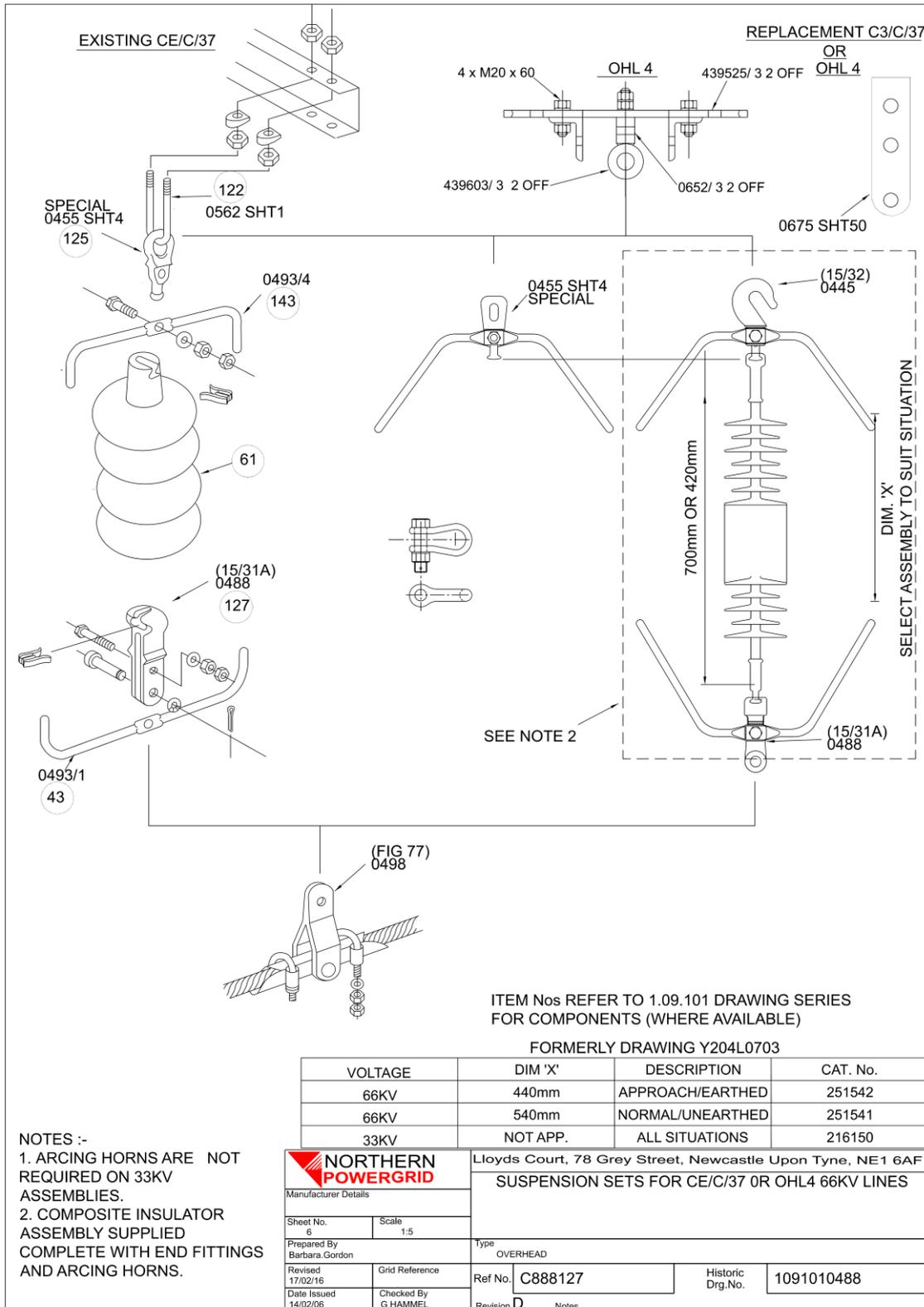
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Appendix 9



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Appendix 10



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Appendix 10a

Materials List for 1091010488 sht6

Suspension sets for OHL4 (66kV) or CE/C/37 construction (33 or 66kV)

Item	No.	Stock Cat No.	Description	Drawing no.	BS 3288 Part 2
61	**	216150	Insulator, 33kV , 70kN Composite Tension/Suspension. 90kV Wet Flashover (Equivalent to 3 X 140mm) – CE/C/37	1091010487 sht23	n/a
	or				
61	**	251542	Insulator, 66kV , 70kN Composite Tension/Suspension. (Equivalent to 5 x 140mm) – For Approach or earthed structures	1091010487 sht20	n/a
	or				
61	**	251541	Insulator, 66kV , 70kN Composite Tension/Suspension. (Equivalent to 5 x 140mm) – for Non-Approach or unearthed structures	1091010487 sht20	n/a
122	1	219360	U Bolt + Taper Washers *	1091010562 sht1	n/a
125	1	253086	66kV 70kN Ball ended hook (arc horn fixing) (supplied with insulator as default) – required for OHL4 or new CE/C/37	1091010445 sht1	Fig 11, Ref 15/32
	Or				
125	1	251908	70kN Ball ended Eye Link (arc horn fixing) <i>(special fitting) Required for old CE/C/37</i>	1091010455 sht4	Ref MA 7146
127	1	250622	Socket Clevis	1091010448 sht1	Fig 21, Ref 15/31A
136	1	246010	Suspension Clamp	1091010498 sht1	Fig 77
142	1	24060 1	Double Arcing Horn (Live End)	1091010493 item1	n/a
143	***	24943 2	Double Arcing Horn (Crossarm End)	1091010493 item4	n/a

The 66kV insulator assemblies are supplied inclusive of items 125, 142, 127 and 43

- * Taper washer to ENA TS 43-96, table 6 (50mm) supplied with U bolt
- ** Select insulator to suit system voltage and Arc Protection requirements
- *** No arcing horns required on 33kV assembly

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Appendix 11

VOLTAGE	DIM 'X'	DESCRIPTION	CAT. No.
66KV	440mm	APPROACH/EARTHED	251539
66KV	540mm	NORMAL/UNEARTHED	251536
33KV	NOT APP.	ALL SITUATIONS	251546

NOTES

1. COMPOSITE INSULATOR ASSEMBLY SUPPLIED COMPLETE WITH END FITTING AND ARcing HORNS.
2. WHERE IT IS REQUIRED TO REPLACE EXISTING HISTORICAL INSULATOR ASSEMBLIES THAT UTILISE SMALLER CONDUCTORS THAN 175mm ACSR, THIS MAY BE ACHIEVED BY REPLACING THIS ASSEMBLY WITH 70KN ASSEMBLIES AS SHOWN ON 1 09 101 0488 SHT8
3. ARRANGEMENT 2 TO BE USED AT 33KV, ARcing HORNS NOT REQUIRED.

ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE STATED

NORTHERN POWERGRID		Lloyds Court, 78 Gray Street, Newcastle Upon Tyne, NE1 6AF	
Manufactured by	Scale	Ref No.	Type
2010115	1:5	C880229	OVERHEAD
Drawn by	Grid Reference	Revision	5304093
G. HAWKES		None	
Approved by	Grid Reference	Revision	5304093
2010115		None	
Drawn by	Grid Reference	Revision	5304093
G. HAWKES		None	

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Appendix 11a

Materials List for 1091010488 sht9

Tension sets for CE/C/37 construction (33 or 66kV)

Item	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
	**	251546	Insulator, 33kV , 125kN Composite Tension. (3 * 178mm disc Equivalent at Unearthed structures) – CE/C/37	ENA TS 43-93 Fig. 9	n/a
	or				
	**	251539	Insulator, 66kV , 125kN Composite Tension (Equivalent to 5 x 178mm disc) – CE/C/37 complete with arcing horns for Approach / earthed structure	1091010487 sht21	n/a
	or				
	**	251536	Insulator, 66kV , 125kN Composite Tension (Equivalent to 5 x 178mm disc) – CE/C/37 complete with arcing horns for Non-Approach structure	1091010487 sht21	n/a
	1	264216	125kN Shackle c/w pin (YEDL Special)	10910100443 sht3	MA7148
	1	224253	125kN Twisted Ball ended Eye Link (Supplied with the insulator)	1091010462sht1	Fig 15, 42/44
	1	241002	125kN Socket Tongue (Supplied with the insulator)	1091010465 sht1	Fig 26, Ref 28/36b
	1	To suit	Compression Dead End (Clevis ended fitting)	To Suit conductor	
	or				
	1	240902	125kN Socket Clevis	1091010463 sht1	n/a
	1	To suit	Compression Dead End (Eye ended fitting)	1091010653 sht1	n/a
			Arcing Horns only required at 66kV		
	1	224964	Single Point Arcing Horn (Live End)	Y204L0708	n/a
	1	224840	Single Point Arcing Horn (Crossarm End)	Y204L0708	n/a

The 66kV insulator assemblies are supplied inclusive of items eye link, socket and acting horn

- ** Select insulator to suit system voltage
 Composite insulator equivalent to 3-disc insulators at 33kV earthed or unearthed
 Composite insulator equivalent to 5-disc insulators at 66kV all structures
 66kV assemblies supplied complete with arcing horns set for approach or non-approach locations.

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Appendix 12a

Materials List for drawing 1091010488 sht8

Tension Insulator set at Earthed and Unearthed position (OHL4 66kV Construction)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
*	1	253086	70kN Ball ended hook fitting (c/w arcing horn hole) (Supplied with the insulator as default)	1091010445 sht1	Fig 11, Ref 15/32
			or		
*	1	264428	70kN Shackle c/w pin	1091010443 sht1	Fig 7, Ref 15/29A
*	1	251907	70kN Ball ended Eye Link	1091010455 sht1	Fig 14, Ref 15/82
	1	250764	70kN Socket tongue	1091010458 sht1	Fig 28, Ref 15/85
	1	248603	70kN Ball clevis (arcing horn fixing)	1091010447 sht1	Fig 17, Ref 15/25A
	1	251560	Insulator, 66kV , 70kN Composite Tension. (5 x 140mm Equivalent) at Normal or Non-Approach structures – 540mm Arc gap. Supplied complete with (15/30) ball ended eye link and (15/35) socket tongue and acting horn	1091010487 sht21 1091010488 sht8	n/a
			Or		
	1	251559	Insulator, 66kV , 70kN Composite Tension. (5 x 140mm Equivalent) at earthed or approach structures - 440mm arc gap. Supplied complete with (15/30) ball ended eye link and (15/35) socket tongue and acting horn	1091010487 sht21 1091010488 sht8	n/a
	1	250622	70kN Socket clevis (c/w arcing horn hole) (Supplied with the insulator as default)	1091010448 sht 1	Fig 21, Ref 15/31A
	1	To suit	Eye ended Compression dead end	To suit	n/a
			or		
	1	250779	70kN Socket tongue (c/w arcing horn hole)	1091010449 sht1	Fig 26, Ref 15/35
	1	248586	70kN Ball clevis	1091010456 sht1	Fig 16, Ref 15/83A
	1	264610	Socket Thimble (large dia)	1091010426 sht3	n/a
			or		
	1	250779	70kN Socket tongue (c/w arcing horn hole)	1091010449 sht1	Fig 26, Ref 15/35
	1	248586	70kN Ball clevis	1091010456 sht1	Fig 16, Ref 15/83A
	1	To suit	Socket ended compression dead end	1091010102 sht9	n/a
			or		
	1	240673	70kN Clamp adapter	1091010450 sht1	Fig 40, Ref 15/27C
	1	To suit	Clevis ended compression dead end	1091010653 sht1	n/a

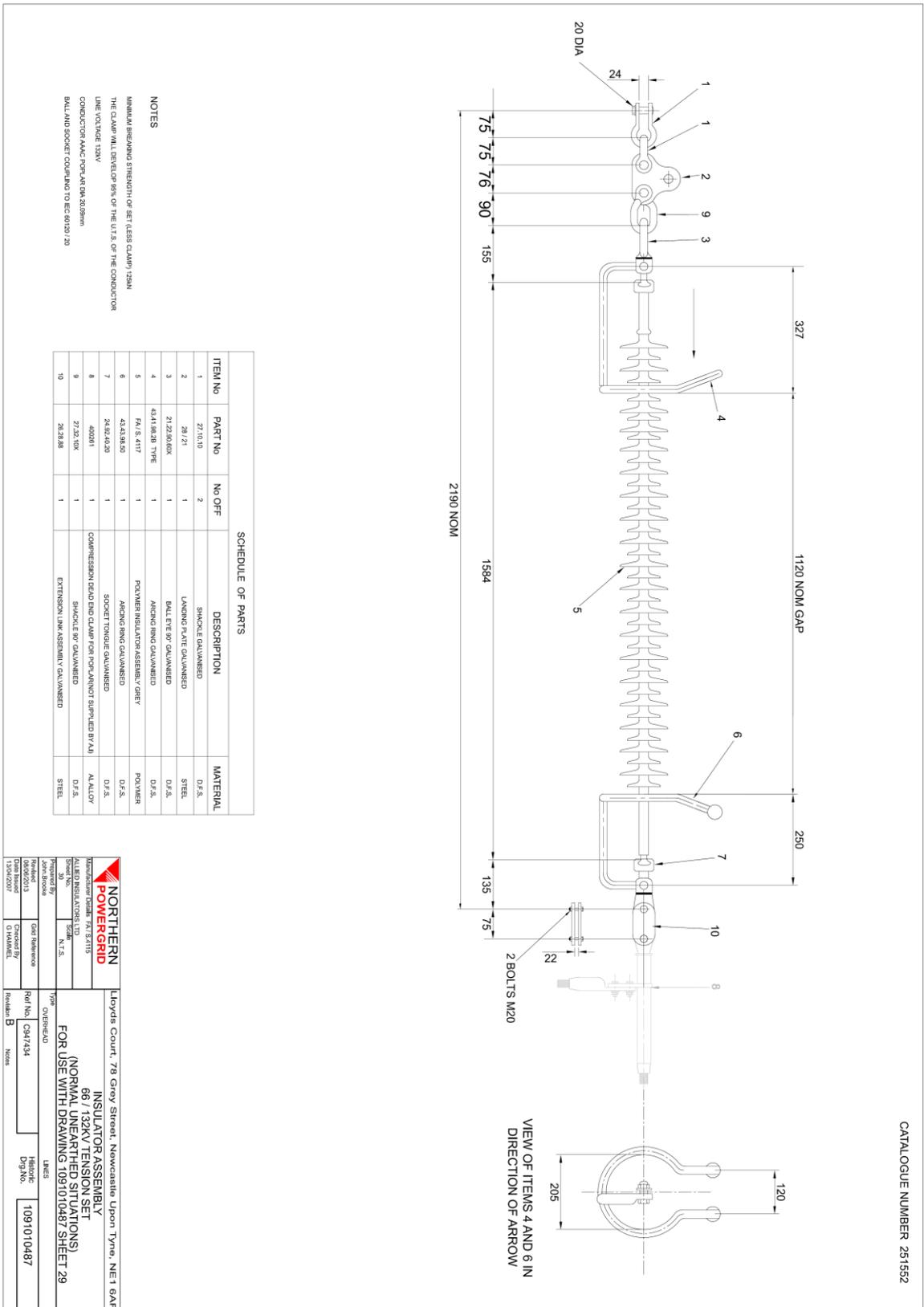
The default assembly shall be with a ball hook arrangement – note, new composite insulator assemblies are supplied complete with ball end eye link, socket tongue and arcing horns. Conductor fittings shall be selected to best suit the conductor size being terminated.

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Appendix 13

<p>ITEM 1 CAT. No. 251548 132kV INSULATOR ITEM 2 CAT. No. 251549 BENDABLE INSULATOR BASE FOR USE WITH ITEM 1 ON OHL9 LINES</p> <p>TECHNICAL DATA Specification Applied: IEC 61952 Latest Issue</p> <table border="1"> <thead> <tr> <th>CHARACTERISTICS</th> <th>RATING</th> </tr> </thead> <tbody> <tr> <td colspan="2">DIMENSIONS</td> </tr> <tr> <td>Arcing Distance, mm</td> <td>1318</td> </tr> <tr> <td>Leakage (Creepage) Distance, mm</td> <td>3625</td> </tr> <tr> <td>Number of Sheds, 'N'</td> <td>34</td> </tr> <tr> <td>Core Diameter, mm</td> <td>76.2</td> </tr> <tr> <td colspan="2">MECHANICAL VALUES</td> </tr> <tr> <td>Maximum Design Cantilever Load, kN</td> <td>10.5</td> </tr> <tr> <td>Routine Tension-load, kN</td> <td>11.1</td> </tr> <tr> <td>Average Cantilever Failing Load, kN</td> <td>21.0</td> </tr> <tr> <td colspan="2">APPROX. NET WEIGHT, kg</td> </tr> <tr> <td></td> <td>44.4</td> </tr> <tr> <td colspan="2">CHARACTERISTICS</td> </tr> <tr> <td colspan="2">ELECTRICAL VALUES</td> </tr> <tr> <td>Wet Power Frequency Withstand Voltage, kV</td> <td>350</td> </tr> <tr> <td>Dry Lightning Impulse Withstand Voltage, kV</td> <td>700</td> </tr> </tbody> </table> <p>NOTES.</p> <ol style="list-style-type: none"> DIMENSIONS ARE IN METRIC (mm) MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MINIMUM AVERAGE CANTILEVER BREAKING LOAD TOLERANCES ARE IN ACCORDANCE WITH IEC 61952 POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH ANSI C29.7 INSULATORS TO BE SUPPLIED WITH CONDUCTOR CLAMPS SUITABLE FOR 200mm AAAC BENDABLE BASE IS ONLY REQUIRED ON INSULATORS THAT ARE USED ON OHL9 SINGLE POLE ASSEMBLIES. WOODHOUSE MAST REPLACEMENT RUTTER POLES DO NOT REQUIRE THE BASE. 	CHARACTERISTICS	RATING	DIMENSIONS		Arcing Distance, mm	1318	Leakage (Creepage) Distance, mm	3625	Number of Sheds, 'N'	34	Core Diameter, mm	76.2	MECHANICAL VALUES		Maximum Design Cantilever Load, kN	10.5	Routine Tension-load, kN	11.1	Average Cantilever Failing Load, kN	21.0	APPROX. NET WEIGHT, kg			44.4	CHARACTERISTICS		ELECTRICAL VALUES		Wet Power Frequency Withstand Voltage, kV	350	Dry Lightning Impulse Withstand Voltage, kV	700	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">NORTHERN POWERGRID</td> <td colspan="2" style="text-align: center;">Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF</td> </tr> <tr> <td colspan="2" style="text-align: center;">ALLIED INSULATORS LTD</td> <td colspan="2" style="text-align: center;">INSULATOR</td> </tr> <tr> <td colspan="2" style="text-align: center;">Sheet No. 15</td> <td colspan="2" style="text-align: center;">Scale 1:5</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prepared By John Brooke</td> <td colspan="2" style="text-align: center;">Type OVERHEAD</td> </tr> <tr> <td colspan="2" style="text-align: center;">Revised 08/09/2013</td> <td colspan="2" style="text-align: center;">STANDARDS</td> </tr> <tr> <td colspan="2" style="text-align: center;">Date Issued 22/03/2007</td> <td colspan="2" style="text-align: center;">Ref No. C946738</td> </tr> <tr> <td colspan="2" style="text-align: center;">Checked By G HAMMEL</td> <td colspan="2" style="text-align: center;">Historic Dwg. No. 1091010487</td> </tr> <tr> <td colspan="2" style="text-align: center;">Revision C</td> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>	NORTHERN POWERGRID		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF		ALLIED INSULATORS LTD		INSULATOR		Sheet No. 15		Scale 1:5		Prepared By John Brooke		Type OVERHEAD		Revised 08/09/2013		STANDARDS		Date Issued 22/03/2007		Ref No. C946738		Checked By G HAMMEL		Historic Dwg. No. 1091010487		Revision C		Notes																												
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SEE DRAWING 1091010487 SHEET 34 TO BE SUPPLIED COMPLETE WITH CONDUCTOR TRUNNION CLAMPS SUITABLE FOR 200mm AAAC <p>MATERIAL: SAE GRADE 9 (ISO 898 - 1:1999, CLASS 12.9) OR EQUIVALENT, GALVANISED</p>	ITEM	COMPONENT	MATERIAL	1	FLANGE END	DUCTILE IRON, HDG	2	WEATHERSHEDS	SILICONE RUBBER	3	FLANGE END	DUCTILE IRON, HDG	4	LABEL	POLYESTER	5	CORE	HIGH QUALITY PULTRUDED FRP ROD	6	VERTICAL CLAMP ADAPTOR (LINDSEY#2121)	DUCTILE IRON, HDG	7	TRUNNION BOLT SET	STEEL, HDG	8	BOLT SET (LE326-P1-1,2,3)	STAINLESS STEEL OR STEEL, HDG	CHARACTERISTICS	RATING	DIMENSIONS		Arcing Distance, mm	1168	Leakage (Creepage) Distance, mm	3375	Number of Sheds, 'N'	30	Core Diameter, mm	76.2	MECHANICAL VALUES		Maximum Design Cantilever Load, kN (Without Vertical Clamp Adaptor)	10.5	Routine Tension-load, kN (Without Vertical Clamp Adaptor)	33.4	Average Cantilever Failing Load, kN (Without Vertical Clamp Adaptor)	21.0	APPROX. 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NOTES

MINIMUM BREAKING STRENGTH OF SET (LESS CLAMP) 125kN
 THE CLAMP WILL DEVELOP 95% OF THE U.T.S. OF THE CONDUCTOR
 LINE VOLTAGE 125KV
 CONDUCTOR IACS POPULARION 20,000mm
 BALL AND SOCKET COMPLYING TO IEC 60120 / 20

SCHEDULE OF PARTS

ITEM No	PART No	QTY	DESCRIPTION	MATERIAL
1	271.01.10	2	SHOCKLE GALVANISED	D.P.S.
2	291 / 21	1	LAMING PLATE GALVANISED	STEEL
3	2123.90.00X	1	BALL EYE 90° GALVANISED	D.P.S.
4	4341.98.20	1	ARMING RING GALVANISED	D.P.S.
5	FA.S. 417	1	POWVER INSULATOR ASSEMBLY GREY	POWVER
6	4343.98.20	1	ARMING RING GALVANISED	D.P.S.
7	2452.04.20	1	SOCKET TONGUE GALVANISED	D.P.S.
8	40201	1	COMPRESSION RING END CLAMP FOR POPULANOT SUPPLIED BY ALI	AL ALLOY
9	2723.10X	1	SHOCKLE 90° GALVANISED	D.P.S.
10	2828.88	1	EXTENSION LINK ASSEMBLY GALVANISED	STEEL

NORTHERN POWERGRID	Prepared By John Brown	Checked By Gordon Brown	Drawn By Gordon Brown
Manufacturing Details FAC 18/715	Scale 1:1	Order Reference N.S.	Revision None
Site No. N.S.	Project No. N.S.	Ref No. C947234	Historic N/A
INSULATOR ASSEMBLY SET 68 (NORMAL UNBARTHEDED SITUATIONS) FOR USE WITH DRAWING 1091010487 SHEET 29			
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF		Drawing No. 1091010487	

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Appendix 13a

Materials List for drawing 1091010487 sht16 & sht18 or sht 30

66/132kV OHL9 & OHL10 Wood Pole Insulator Assemblies for Unearthed or Non-Approach structures

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
Intermediate Pole					
	1	251551	132kV composite vertical post Insulator with pedestal mounting suitable for OHL9 or OHL10	1091010487 sht18	n/a
	2	251549	132kV composite horizontal post Insulator with 63mm core and aluminium mounting gain suitable for OHL9	1091010487 sht16 Item 2	n/a
		or			
	3	251548	132kV composite horizontal post Insulator with 63mm core – no bendable base suitable for OHL10	1091010487 sht16 Item 1	n/a
Section/Tension Pole					
	6	251552	Insulator, 132kV, 120kN Composite tension Insulator assembly mounted on Non-Approach structure, suitable for operation at 33, 66 or 132kV operation. Supplied with arching horns with gap from 1175 – 540mm	1091010487 sht. 30 & 1091010487 sht. 29	n/a
	1 Or 2	251550	132kV composite vertical post Insulator with pedestal mounting, Mounting Stool and armour grip suspension clamps	1091010487 sht18	n/a

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Appendix 14

CATALOGUE NUMBER 346398 ARCING HORN KIT

NOTES:

- DIMENSIONS ARE IN MILLIMETRES
- MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MAXIMUM AVERAGE CANTILEVER BREAKING LOAD.
- TOLERANCES ARE IN ACCORDANCE WITH BS 4192
- POSITIVE TOLERANCE TO LIKAGE (CREEPAGE) DISTANCE IS NOT LIMITED.
- CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH BS 6231
- ITEM 4 (BENDABLE BASE) NOT USED FOR WOODHOUSE CONSTRUCTION
- CONDUCTOR CLAMP SUITABLE FOR USE WITH 28mm AAC
- CONDUCTOR TO BE SUPPLIED WITH INSULATOR

SCHEDULE OF PARTS			
ITEM No	PART No	No OFF	DESCRIPTION
1		1	HORIZONTAL CLAMP-TOP
2	FA.S.4132	1	POLYMER INSULATOR UNIT
3		1	POKER DEV
4	FA.6016.MOD	1	ARCING RING GALVANISED
5	FA.6016.MOD	1	ARCING RING GALVANISED
6	FA.6021	1	POKER DEVICE TO DOWN GRADE

DIMENSIONS

ARCING DISTANCE mm 1316
 LEANAGE (CREEPAGE) DISTANCE mm 3026
 NUMBER OF SHEDS 34
 CORE DIAMETER 76.2

MECHANICAL VALUES

MAXIMUM DESIGN CANTILEVER LOAD kN 10.5
 MAXIMUM TENSION LOAD kN 11.1
 AVERAGE CANTILEVER FAILING LOAD kN 21.0

APPROX NET WEIGHT kg 43.6

ELECTRICAL VALUES

WET POWER FREQUENCY WITHSTAND VOLTAGE kV 350
 DRY LIGHTING IMPULSE WITHSTAND VOLTAGE kV 700

SEE FA.S.4133
L54N3423 (WITH ARCING HORNS)

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR ASSEMBLY 66/132KV COMPOSITE HORIZONTAL POST ASSEMBLY (APPROACH/EARTHED SITUATIONS) FOR USE WITH DRAWINGS 1091010487 SHT 16

Prepared By: John Brooke	Checked By: G.HAMMILL	Ref No: C947173	Historic Drg No: 1091010487
Drawn: 21/12/2011	Checked By: G.HAMMILL	Rev No: B	Notes:

CAT. No 346397

SCHEDULE OF PARTS			
ITEM No	PART No	No OFF	DESCRIPTION
1		1	FLANGE END GALVANISED
2	FA.6016.MOD	1	ARCING RING GALVANISED
3	FA / S. 4134	1	POLYMER INSULATOR UNIT GREY
4		1	FLANGE END GALVANISED
5		1	CONDUCTOR CLAMP
6	FA.6016.MOD	1	ARCING RING GALVANISED
7	FA. 6021	1	POKER DEVICE TO DOWN GRADE GAP 12 DIA ROD

NOTES

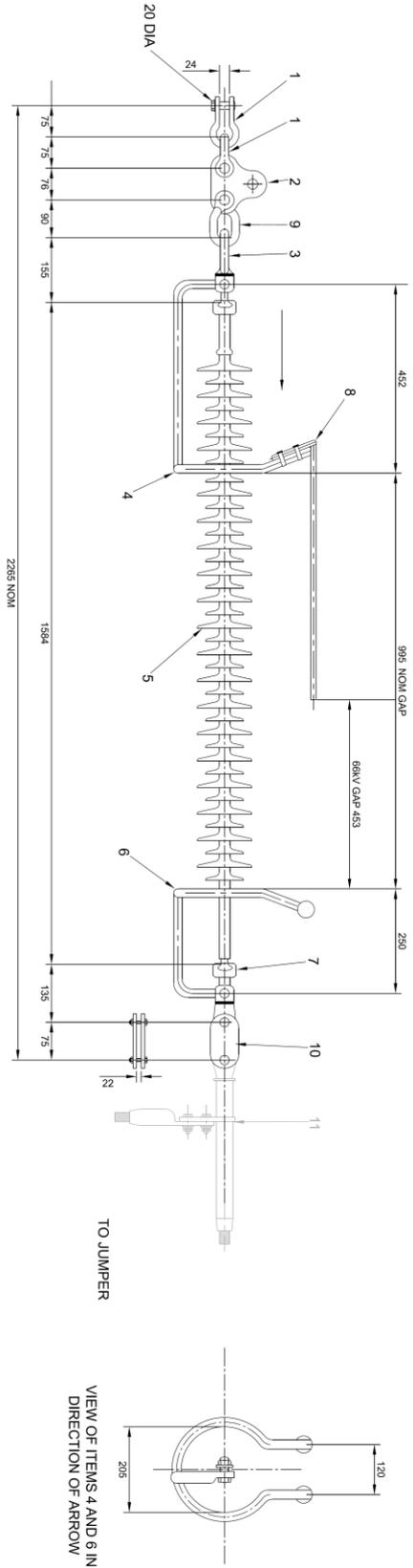
- NOTES AND CHARACTERISTICS AS DRAWING FA.S.4134
- ITEM 7 POKER DEVICE USED WHEN 66kV GAP REQUIRED

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR ASSEMBLY 66/132KV COMPOSITE VERTICAL POST/PILOT ASSEMBLY (APPROACH / EARTHED SITUATIONS) FOR USE WITH 1 09 101 0487 SHEET 18

Prepared By: John Brooke	Checked By: G.HAMMILL	Ref No: C947338	Historic Drg No: 1091010487
Drawn: 08/05/2013	Checked By: G.HAMMILL	Rev No: A	Notes:

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CATALOGUE No. 251553 132kV OPERATION
251554 66/33kV OPERATION

NOTES

THE M 19 POWER DEVICE USED WHEN 68kV GAP IS REQUIRED
MINIMUM BREAKING STRENGTH OF SET (LESS CLAMP) 125kV
THE CLAMP WILL DEVELOP 99% OF THE U.T.S. OF THE CONDUCTOR
LINE VOLTAGE 120V
CONDUCTOR AAC POPULAR DIA 20.06mm
BALL AND SOCKET COUPLING TO EC 69120 / 20

SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION	MATERIAL
1	27.10.10	2	SHACKLE GALVANISED	D.F.S.
2	28 / 21	1	LANDING PLATE GALVANISED	STEEL
3	21.22.90.00X	1	BALL EYE 80° GALVANISED	D.F.S.
4	43.4.198.29 TYPE	1	ARCING RING GALVANISED	D.F.S.
5	PA / S. 4117	1	POLYMER INSULATOR ASSEMBLY GREY	POLYMER
6	43.4.38.50	1	ARCING RING GALVANISED	D.F.S.
7	24.82.40.20	1	SOCKET TONGUE GALVANISED	D.F.S.
8	FR6022	1	POWER DEVICE FOR 68kV GAP X = 682	12 DIA STEEL ROD
9	27.32.10X	1	SHACKLE 80° GALVANISED	D.F.S.
10	26.26.88	1	EXTENSION LINK ASSEMBLY GALVANISED	STEEL
11	40263	1	COMPRESSION DEAD END FOR POPULAR NOT SUPPLIED BY P.A.I.	AL ALLOY

<p>Reference: 1104/2007</p>	<p>Drawn By: John Brooke</p>	<p>Checked By: G HAMMILL</p>	<p>Loyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF</p> <p>INSULATOR ASSEMBLY 66 / 132kV TENSION SET (APPROACH / ENLARGED SITUATIONS) FOR USE WITH DRAWING 1 09 101 0487 / SHEET 29</p>
	<p>Scale: N.T.S.</p>	<p>Grid Reference</p>	
	<p>Revised By: John Brooke</p>	<p>Revised By: G HAMMILL</p>	
	<p>Revision: B</p>	<p>Historic Dwg. No. 1091010487</p>	

Document Reference: - NSP/004/127		Document Type: - Code of Practice	
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Appendix 14a

Materials List for drawing 1091010487 sht32 & sht33 or sht 31

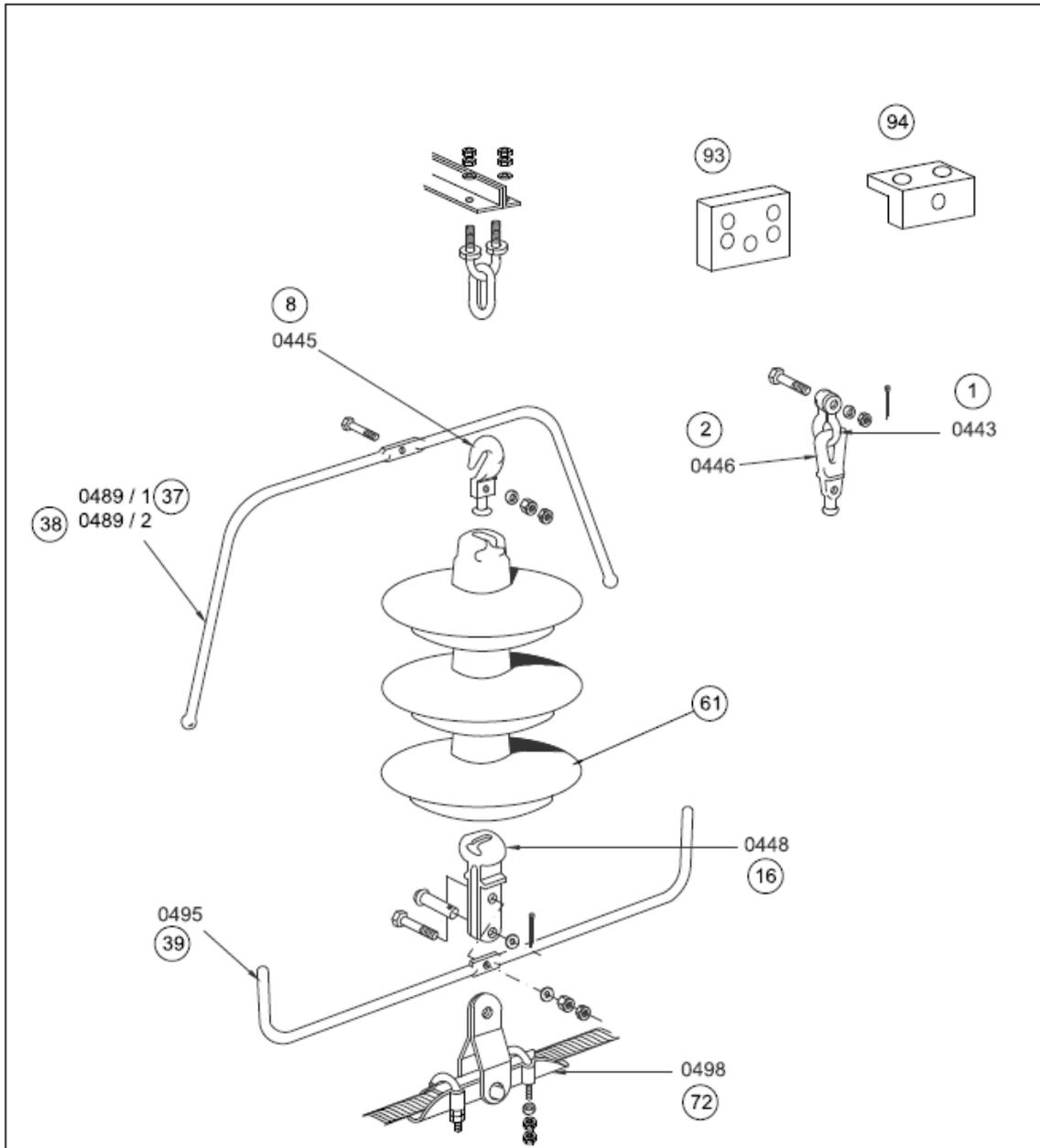
66/132kV OHL9 & OHL10 Wood Pole Insulator Assemblies On Approach or earthed structures

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
Intermediate Pole					
	1	251551	132kV composite vertical post Insulator with pedestal mounting	1091010487 sht18	n/a
*	1 Or 2	346397	Arcing horn kit and extension arc horn for application onto the vertical post insulator (1091010487 sht. 18) in approach zones	1091010487 sht. 32	n/a
	2	251549	132kV composite horizontal post Insulator with 63mm core and aluminium mounting gain suitable for OHL9	1091010487 sht16	n/a
		or			
	3	251548	132kV composite horizontal post Insulator with 63mm core – no bendable base suitable for OHL10	1091010487 sht16	n/a
*	2	346398	Arcing horn kit and extension arc horn for application onto the Horizontal post insulator (1091010487 sht. 16) in approach zones	1091010487 sht. 33	n/a
Section/Tension Pole					
	6	251553	Insulator, 132kV, 120kN Composite tension Insulator designed for 132kV operation on Approach structure	1091010487 sht. 29 & 1091010487 sht. 31	n/a
		or			
	6	251554	Insulator, 132kV, 120kN Composite tension Insulator designed for 66kV operation on Approach structure	1091010487 sht. 29 & 1091010487 sht. 31	n/a
	1 Or 2	251550	132kV composite vertical post Insulator with pedestal mounting, Mounting Stool and armour grip suspension clamps	1091010487 sht18	n/a
*	1 Or 2	346397	Arcing horn kit and extension arc horn for application onto the vertical post insulator (1091010487 sht.18) in approach zones	1091010487 sht. 32	n/a

***Poker Device used to reduce gap when system operating voltage is 66kV**

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Appendix 15



ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWINGS
(WHERE AVAILABLE)

FORMERLY DRAWING Y707L0704

		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Manufacturer Details: Sheet No. 7 Scale N,1,5 Prepared By John Brooke		132KV OVERHEAD LINES 70KN SUSPENSION INSULATOR SET	
Revised 08/06/13 Gtd Reference Date Issued 24/01/06 Checked By		Type OVERHEAD Ref No. C729204	Historic Drg.No. 1091010428
		Revision A	Notes

Document Reference: -	NSP/004/127	Document Type: -	Code of Practice				
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Appendix 15a

Materials List for drawing 1091010428 sht7 70kN Suspension insulator set (66/132kV Tower lines)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
1	1	264428	70kN Shackle	1091010443 sht1	Fig 7, Ref 15/29A
6	1	240743	70kN Ball Ended Eye Link	1091010446 sht1	Fig 13, Ref 15/30
			Or		
8	1	253086	70kN Ball Ended Hook	1091010445 sht1	Fig 11, Ref 15/32
37	1	254591	Double Ended Arcing Horn (Earth end) Approach Set c/w M16mm * 65mm Bolt	1091010489 sht1 item2	7 SA*
			Or		
38	1	240635	Double Ended Arcing Horn (Earth end) Normal Set c/w M16 * 65mm Bolt	1091010489 sht1 item1	7 SB*
61	*		See Insulator Selection below		
16	1	250622	70kN Socket Clevis	1091010448 sht1	Fig 21, Ref 15/31A
39	1	240616	Double Ended Arcing Horn (Live end)	1091010495 sht1	4 SC*
72	1	246010	Suspension Clamp (Tongue Ended)	1091010498 sht1	Fig77
			Special Construction alternatives		
28	1	225151	Chain Link	-	ENA TS 43-9 fig 6
48	1	-	U Bolt	-	NGC 43.84.066*
93*	1	-	Landing Plate	Y707L0902	-
94*	1	-	Landing Cleat	Y707L0901	-

Cat Number	Purpose for Insulator assembly	Existing drawing reference
251535	66kV Suspension Assembly 70kN, with 16mm ball hook (15/32) and socket clevis fittings - 440mm arcing horn gap on approach structures	Composite equivalent of 1091010428 sht. 7
251534	66kV Suspension Assembly, with 16mm ball ended hook (15/32) and socket clevis fittings - 540mm arcing horn gap on Non approach structures	Composite equivalent of 1091010428 sht. 7
251533	132kV Suspension Assembly 70kN, 11 x 140mm spacing, with 16mm ball ended hook (15/32) and socket clevis fittings - 1000mm arcing horn gap on approach construction	Composite equivalent of 1091010428 sht. 7
251561	132kV Suspension Assembly 70kN, 11 x 140mm spacing, with ball ended hook (15/32) and socket clevis fittings - 1175mm arcing horn gap on non-approach or normal construction	Composite equivalent of 1091010428 sht. 7
251562	132kV Suspension Assembly - reduced clearance , 70kN, 9 x 140mm spacing with 16mm ball ended hook (15/32) and socket clevis fittings - 925mm arcing gap for approach construction.	Composite equivalent of 1091010428 sht. 7
251531	132kV Suspension Assembly - reduced clearance , 70kN, 9 x 140mm spacing with 16mm ball ended hook (15/32) and socket clevis fittings - 1025mm arcing gap for non-approach or normal construction	Composite equivalent of 1091010428 sht. 7

All composite insulator assemblies are supplied inclusive of items 6, 16, 38, and 39
Replaces previous drawings Y707L0704, 1091010428 sht1 and 1091010488 sht1

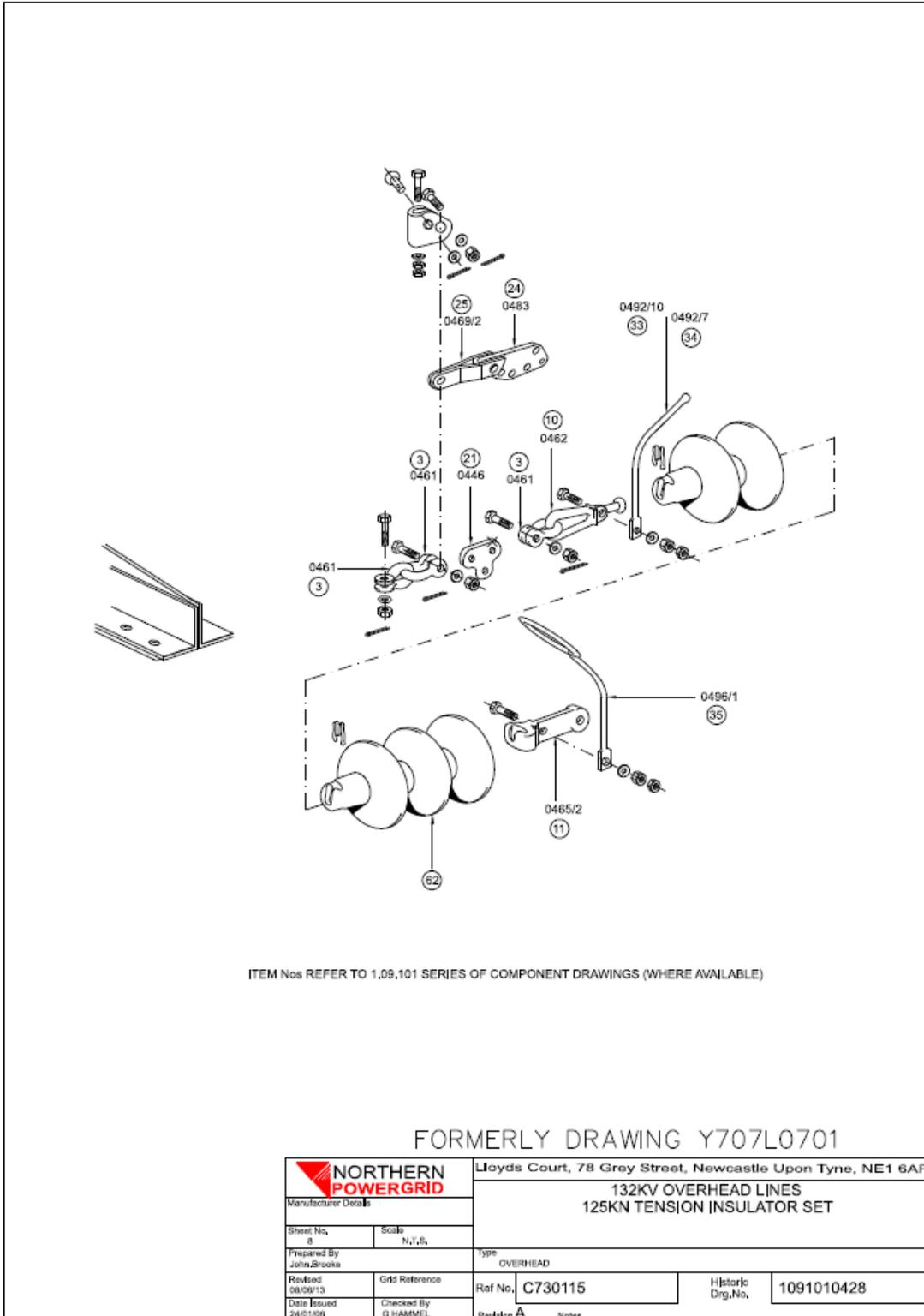
Notes

* NGC and CEGB specifications may be no longer available in Northern PowerGrid database.

Drawing to be replaced with a composite assembly drawing

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Appendix 16



Document Reference: -	NSP/004/127	Document Type: -	Code of Practice				
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Appendix 16a

Materials List for drawing 1091010428 sht8 125kN Tension insulator set (66/132kV Tower lines)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
3	3	226365	125kN Shackle	1091010461 sht1	Fig 7, Ref 28/29A
24	1	225946	125kN Sag Adjuster Plate	1091010483 sht5	Fig 55, Ref 28/100
25	1	240175	125kN Cranked Links	1091010469 sht1 item 2	Fig 47, Ref 28/87A
			Or		
21	1	225938	125kN Landing Plate	1091010466 sht1	Fig 53, Ref 28/21
10	1	224253	125kN Ball Ended Eye Link	1091010455 sht3	Fig13, Ref 28/30
33	1	240546	Single Point Arcing Horn (Earth end) Approach Set c/w M16mm * 65mm Bolt	1091010492 item10	7 TA*
			Or		
34	1	240527	Single Point Arcing Horn (Earth end) Normal Set c/w M16 * 65mm Bolt	1091010492 item7	7 TB*
62			See Insulator Selection below		
11	1	241002	125kN Socket Tongue	1091010465 sht1 item 2	Fig 26, Ref 28/36B
35	1	240584	Arcing Horn (Live end) – Use with Tongue	1091010496 sht1 Item 1	7 TC*
			Or		
11	1	240902	125kN Socket Clevis	1091010463 sht1	Fig 21, Ref 28/31A
35	1	254572	Arcing Horn (Live end) – Use with Clevis	1091010496 sht1 item 2	7 TC*
			Where required		
54	1		Swivel c/w ¾ * 6" bolt, ¾ * 3" bolt & 5/8 * 2" Pin	Y707L0709	-

Insulator Selection

Cat Number	Purpose for Insulator assembly	Drawing reference
251530	66kV Tension Assembly, (120kN) based on 5 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue, 440mm arc gap on approach construction	Composite equivalent of 1091010428 sht. 8 66kV version
251563	66kV Tension Assembly, (120kN) based on 5 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue, 540mm arc gap on non-approach construction	Composite equivalent of 1091010428 sht. 8 66kV version
251528	132kV Tension Assembly (120kN) based on 9 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue with 1000mm arc gap on approach construction	Composite equivalent of 1091010428 sht. 8
251564	132kV Tension Assembly (120kN) based on 9 x 178mm spacing, 20mm ball ended eye link fitting and socket tongue with 1175mm arc gap on non-approach construction	Composite equivalent of 1091010428 sht. 8

All composite insulator assemblies are supplied inclusive of items 10, 11, 16, 33, 34 or 35

Notes

* NGC and CEGB specifications may be no longer available in Northern PowerGrid database.

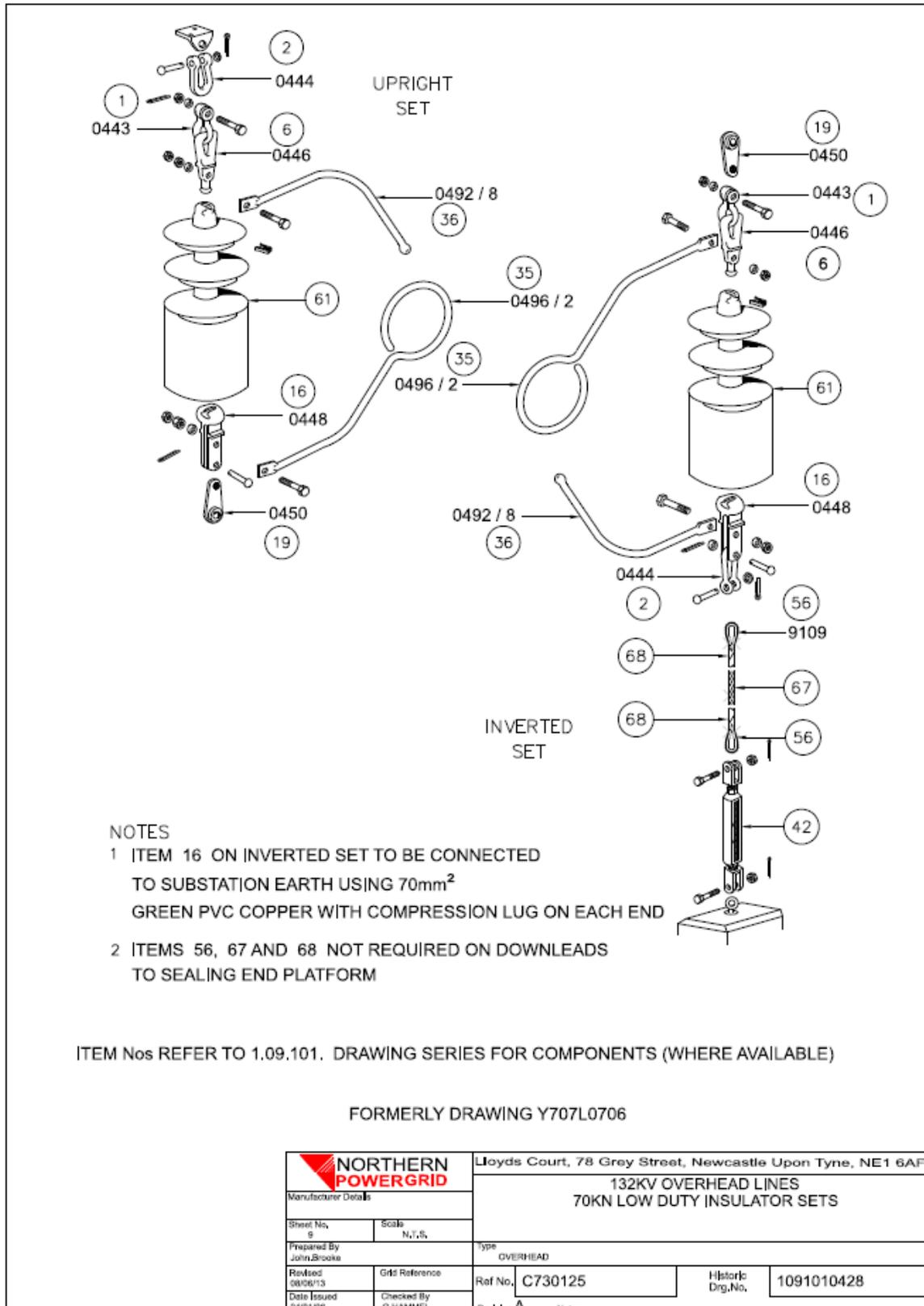
** Insulators to suit voltage

5 discs required at 66kV, and 9 discs required at 132kV

Replaces previous drawings Y707L0701 and 1091010428 sht2

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Appendix 17



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Appendix 17a

Materials List for drawing 1091010428 sht9

70kN Low Duty Inverted or Upright insulator set (66/132kV Tower lines)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
1	2	264428	70kN Shackle (Pinned)	1091010443 sht1	Fig 7, Ref 15/29A
2	2	240847	70kN Pinned Shackle	1091010444 sht1	Fig 8, Ref 15/33A
6	2	225110	70kN Ball Ended Eye Link	1091010455 sht2	Fig 13, Ref 15/30
36	2	240531	Arcing Horn (Earth end)	1091010492 sht1 item 8	7 LA*
61			See Insulator Selection below		
35	2	254572	Single Point arcing Horn (Line End)	1091010496 item 2	7 TC*
16	1	250622	70kN Socket Clevis	1091010448 sht1	Fig 21, Ref 15/31A
19	1	240669	70 kN Clamp Adapter Link	1091010450 sht1	Fig 40, Ref 15/27B
56	2	244922	Stay Wire Thimble	1000439109 sht1	-
68	2	255217	Helical Stay Grip	10910110541 sht1 item1	-
67	-	231481	7/4.00mm stay wire	-	-
42	1	-	Turnbuckle - Clevis/Clevis	-	-

Insulator Selection

Stock Cat No.	Description	Drawing
251526	66kV Low Duty Assembly for down leads to include for both upright and inverted sets - 70kN, 2 x (5 x 140mm spacing) with 16mm ball ended eye link and socket tongue - 440mm arcing horn gap	Composite equivalent of 1091010428 sht9 66kV version
251525	132kV Low Duty Assembly for down leads to include both upright and inverted sets - 70kN, 2 x (11 x 140mm spacing) with 16mm ball ended eye link and socket tongue fittings - 1000mm arcing horn gap	Composite equivalent of 1091010428 sht9

All composite insulator assemblies are supplied inclusive of items 6, 36, 35 and 16

Y707L0706
1091010428 sht3
1091010488 sht3

Notes

- * NGC and CEBG specifications may be no longer available in Northern PowerGrid database.
- 1 Item 16 on the inverted set to be connected to Substation earth using 70mm² Green PVC covered Copper conductor with compression lug on each end.
- 2 Item 56,67,68 not required on down leads to sealing end platform

Drawing to be replaced with a composite assembly drawing

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Appendix 18

ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWING Nos (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0702

		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Manufacturer Details		132KV OVERHEAD LINES TWIN 125KN TENSION INSULATOR SET	
Sheet No. 10	Scale N.T.S.	Type OVERHEAD	
Prepared By John Brooke	Revised 08/06/13	Ref No. C730116	Historic Drg.No. 1091010428
Date Issued 24/01/06	Checked By G HAMMEL	Revision A	Notes

Document Reference: -	NSP/004/127	Document Type: -	Code of Practice				
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Appendix 18a

Materials List for drawing 1091010428 sht10

Twin 125kN Tension insulator set (132kV Tower lines)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
41	2	-	Tower Swivel c/w 1" * 3" bolt, washer and 2 nuts	-	NGC CC43.24.648*
23	2+	250923	Sag Adjuster Links c/w (M24 * 76mm Pin)	1091010483 sht3	Fig 48, Ref 42/102A
31	2	-	Sag Adjuster Plate D (Pins H & J)	1091010483 sht3	Fig 56, Ref 42/100
32	2	250919	Sag Adjuster Plate E	1091010483 sht3	Fig 57, Ref 42/101
5	2	250938	Sag Adjuster Shackle (Pin L)	1091010483 sht3	Fig 7, Ref 42/103
10	1	224253	125kN Ball Ended Eye Link	1091010455 sht3	Fig 13, Ref 28/30
33	1	240546	Single Point Arcing Horn (Earth end) Approach Set c/w M16mm * 65mm Bolt	1091010492 Sht1 item10	7 TA*
			Or		
34	1	240527	Single Point Arcing Horn (Earth end) Normal Set c/w M16 * 65mm Bolt	1091010492 Sht1 item7	7 TB*
			See Insulator Selection below		
11	1	241002	125kN Socket Tongue	1091010465 Sht1 item 2	Fig 26, Ref 28/36B
35	1	240584	Arcing Horn (Live end) – Use with Tongue	1091010496 Sht1 Item 1	7 TC*
			Or		
11	1	240902	125kN Socket Clevis	1091010463 Sht1	Fig 21, Ref 28/31
35	1	254572	Arcing Horn (Live end) – Use with Clevis	1091010496 Sht1 item 2	7 TC*

Insulator Selection

Cat Number	Purpose for Insulator assembly	Existing drawing reference
251524	132kV Tension Assembly – (Twin Lynx Tower Lines) - (120kN) 20mm ball ended eye link fitting and socket tongue based on 2 off 9 x 178mm spacing assemblies with 1000mm gap on approach	Composite version of 1091010428 sht10
251523	132kV Tension Assembly – (Twin Lynx Tower Lines) - (120kN) 20mm ball ended eye link fitting and socket tongue based on 2 off 9 x 178mm spacing assemblies with 1175mm gap on non-approach.	Composite version of 1091010428 sht10

All composite insulator assemblies are supplied inclusive of items 10, 33, 34, 11, 35 and 16

Notes

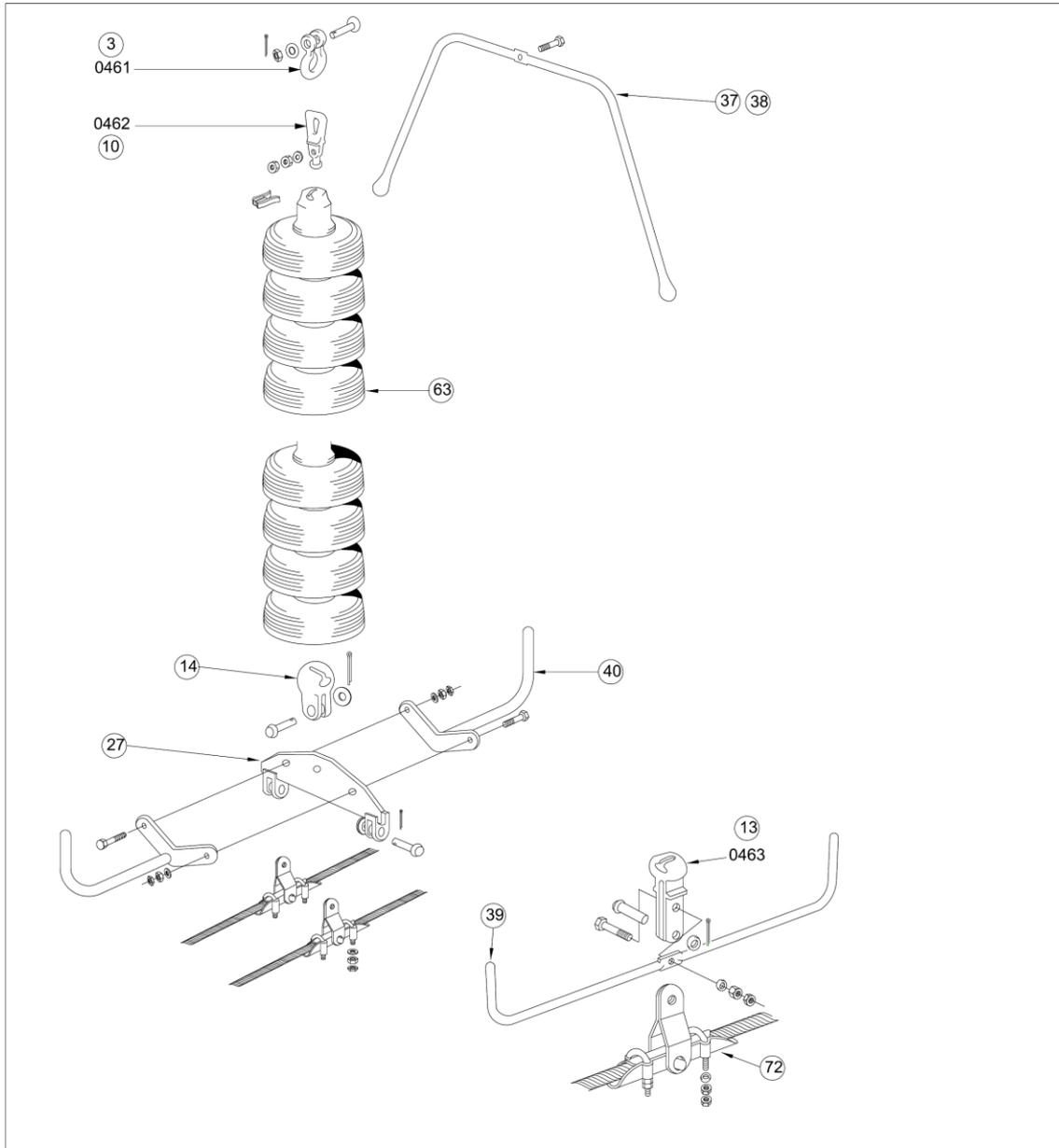
* NGC and CEGB specifications may be no longer available in Northern PowerGrid database.

Replaces previous drawings
Y707L0702

Drawing to be replaced with a composite assembly drawing

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Appendix 19



ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWINGS (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0705

		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
		132KV OVERHEAD LINES 125KN SUSPENSION INSULATOR SET	
Manufacturer Details		Type OVERHEAD	
Sheet No. 11	Scale N.T.S.	Ref No. C730124	Historic Drg.No. 1091010428
Prepared By John Brooke	Grid Reference	Revision A	Notes
Revised 08/06/13	Checked By G HAMMEL		
Date Issued 24/01/06			

Document Reference: -	NSP/004/127	Document Type: -	Code of Practice				
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Appendix 19a

Materials List for drawing 1091010428 sht11

125kN Suspension Insulator Set (Twin or Large Single Conductor)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
3	3	226365	125kN Shackle	1091010461 sht1	Fig 7, Ref 28/29A
10	1	224253	125kN Ball Ended Eye Link	1091010455 sht3	Fig 13, Ref 28/30
37	1	-	Double Point Arcing Horn (Earth end) Approach Set c/w M16mm * 60mm Bolt	-	7 SA*
			Or		
38	1	225078	Double Point Arcing Horn (Earth end) Normal Set c/w M16 * 60mm Bolt	1091010497 sht3	7 SB*
			See Insulator Selection below		
14	1	241017	125kN Socket Clevis	1091010464 sht1	Fig 20, Ref 28/37A
27	1	-	125kN Yoke Plate	-	Fig 68, Ref 28/22A
40	1	-	Arcing Horn (Live end) c/w 2 M16 * 75mm bolts	-	NGC Ref 3/2/132sc*
72	2	-	Suspension Clamp (Lynx)		NGC Ref Type 1*
			Or		
13	1	240902	125kN Socket Clevis	1091010463 sht1	Fig 21, Ref 28/31
39	1	225086	Double Point Arcing Horn (Live end)	-	NGC Ref 4 SC*
72	1	-	Suspension Clamp (Zebra)	-	NGC Ref Type 2*
72	1	-	Suspension Clamp (Finch, Rubus)	-	NGC Ref Type 3*

Insulator Selection

251522	132kV Suspension (125kN) Assembly (Twin Lynx or single large conductor Tower Line), 11 x 171mm spacing composite version 1000mm arc gap on approach	Composite version of 1091010428 sht11
251521	132kV Suspension (125kN) Assembly (Twin Lynx or single large conductor Tower Line), 11 x 171mm spacing composite version 1175mm arc gap non-approach.	Composite version of 1091010428 sht11

All composite insulator assemblies are supplied inclusive of items 10, 37, 38, 13, 14, 39

Notes

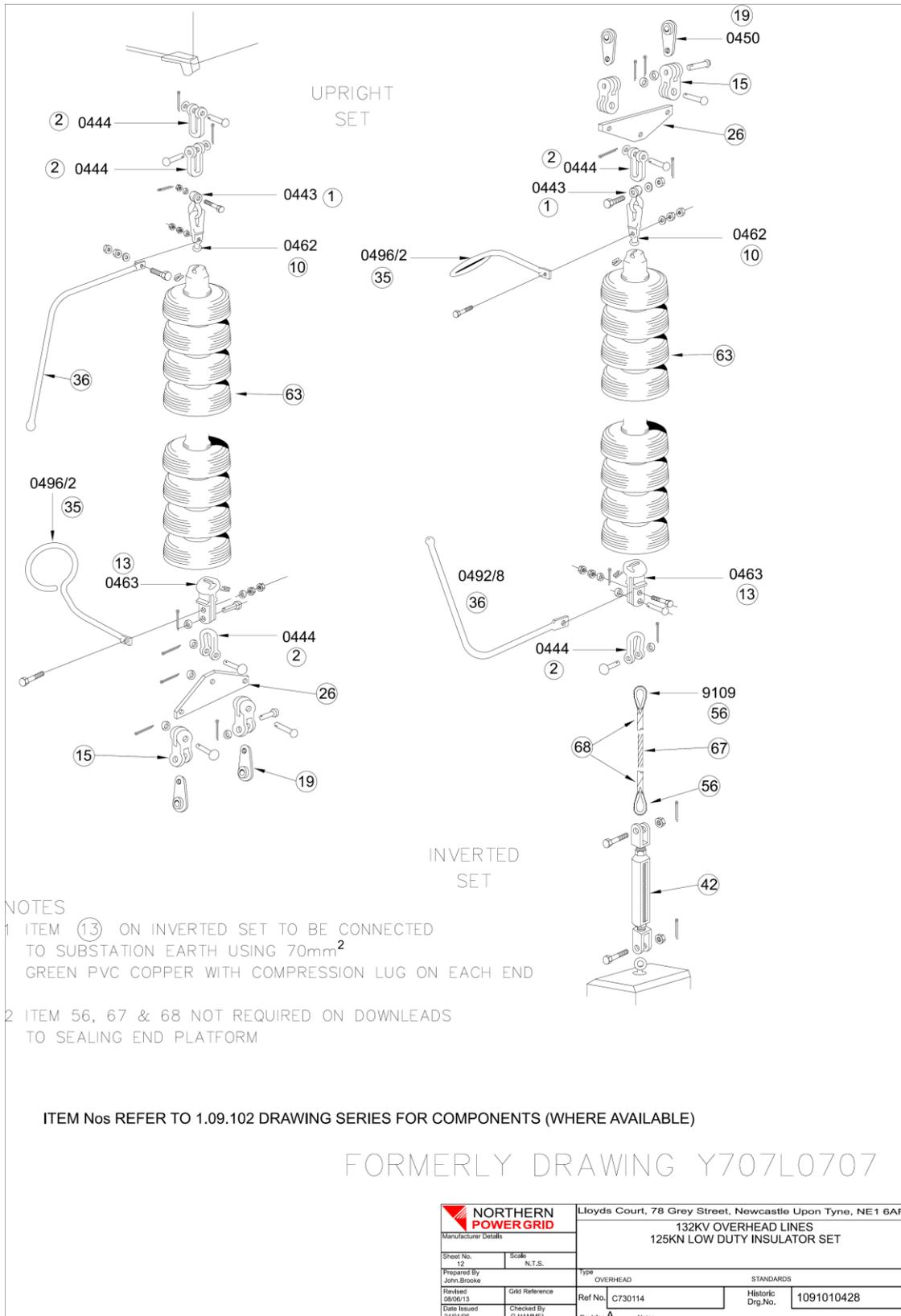
* NGC and CEGB specifications may be no longer available in Northern PowerGrid database.

Replaces previous drawings
Y707L0705

Drawing to be replaced with a composite assembly drawing

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Appendix 20



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Appendix 20A

Materials List for drawing 1091010428 sht12

125kN Inverted & Upright Low Duty Insulator Set

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
1	2	264428	Shackle (Pinned) requires 60mm Pin & split pin	1091010443 sht1	Fig 7, Ref 15/29A
2	4	-	Pinned Shackle	1091010444 sht1	Fig 8, Ref 15/33A
10	2	224253	125kN Ball Ended Eye Link	1091010455 sht3	Fig 13, Ref 28/30
36	2	-	Single Point Arcing Horn (Earth end) c/w M16mm * 60mm Bolt	-	7 LA*
63	1	251520	132kV Low Duty Insulator Assembly for 120kN down leads - To include both Upright and Inverted insulator assemblies c/w, ball ended eye link and socket tongue and arcing horns with 1000mm arc gap	composite version of 1091010428 sht. 12	-
13	2	240902	Socket Clevis	1091010463 sht1	Fig 21, Ref 28/31
15	4	-	Twin Twisted Clevis	-	Fig 37, Ref 15/23
19	4	240669	70 kN Clamp Adapter Link	1091010450 sht1	Fig 40, Ref 15/27B
26	2	-	Yoke Plate	-	Fig 64, Ref 15/22
35	2	254572	Single Point arcing Horn (Line End)	1091010496 sht1 item 2	7 TC*
42	1	-	Turnbuckle - Clevis/Clevis	-	-
56	2	244922	Stay Wire Thimble	1000439109 sht1	-
67	-	231481	7/4.00mm stay wire	-	-
68	2	255217	Helical Stay Grip	1091010541 sht1 item1	-

All composite insulator assemblies are supplied inclusive of items 10, 36, 13, 35

Notes

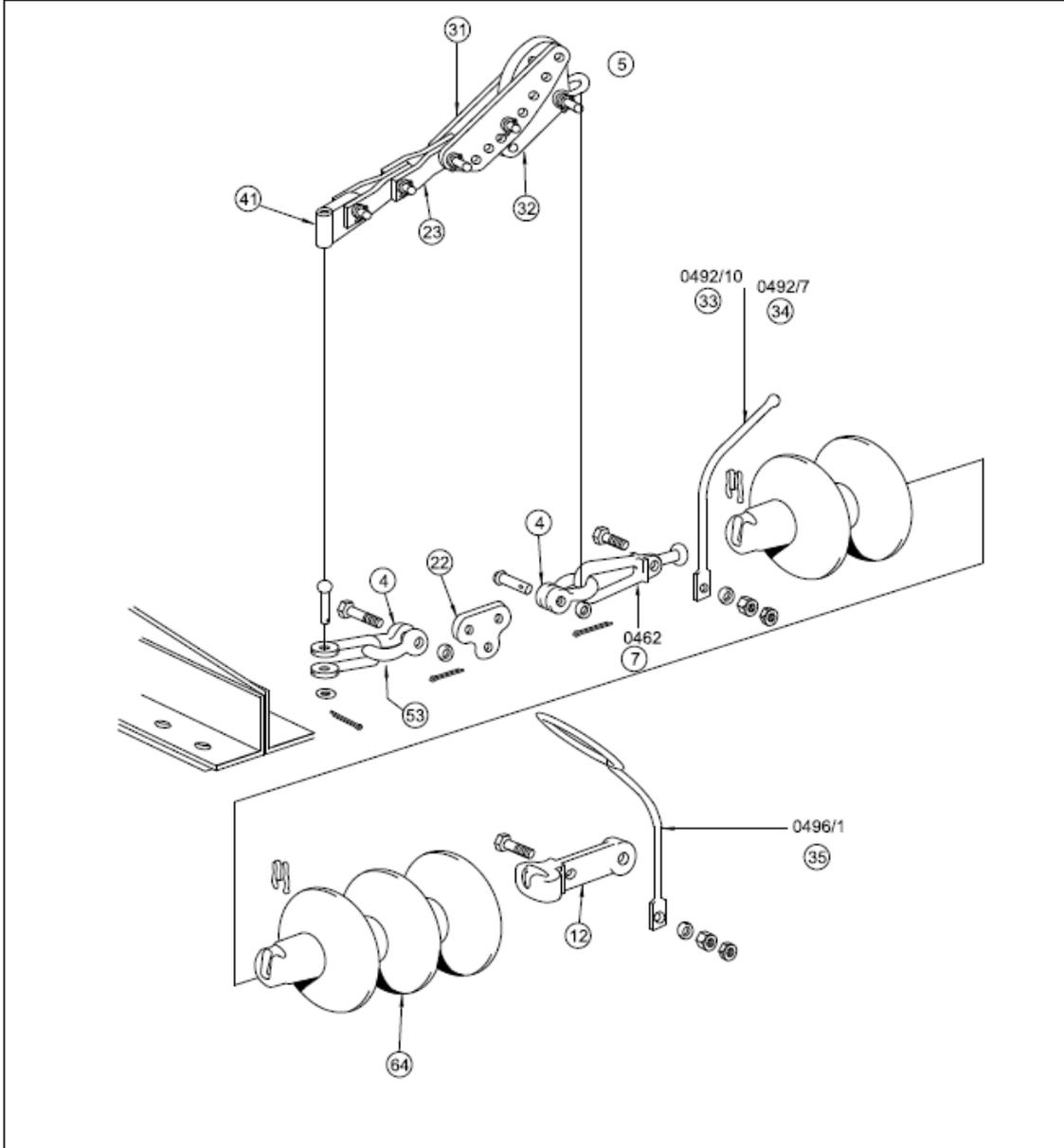
- * NGC and CEGB specifications may be no longer available in Northern PowerGrid database.
- 1 Item 13 on inverted set to be connected to Substation earth using 70mm² green PVC copper with compression lugs on each end.
- 2 Items 56, 67, 68 not required on Downloads to sealing end platforms

Replaces previous drawings
Y707L0707

Drawing to be replaced with a composite assembly drawing

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Appendix 21



ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DGNS (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0703

		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Manufacturer Details		132KV OVERHEAD LINES 190KN TENSION INSULATOR SET	
Sheet No. 13	Scale N.T.S.	Type OVERHEAD	
Prepared By John Brooker	Grid Reference	Ref No. C730123	Historic Drg.No. 1091010428
Revised 08/06/13	Date Issued 24/01/06	Checked By G HAMMEL	Revision A

Document Reference: -	NSP/004/127	Document Type: -	Code of Practice				
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Appendix 21a

Materials List for drawing 1091010428 sht13

190kN Tension Insulator Set (132kV Tower lines)

Item No.	No.	Stock Cat No.	Description	Drawing No.	BS 3288 Part 2
41	1	-	Tower Swivel c/w 1" * 3" bolt, washer and 2 nuts	-	NGC CC43.24.648*
23	1	250923	Sag Adjuster Links c/w (M24 * 76mm Pin)	1091010483 sht3	Fig 48, Ref 42/102
31	1	-	Sag Adjuster Plate D (Pins H & J)	1091010483 sht3	Fig 56, Ref 42/100
32	1	250919	Sag Adjuster Plate E	1091010483 sht3	Fig 57, Ref 42/101
5	2	250938	Sag Adjuster Shackle (Pin L)	1091010483 sht3	Fig 7, Ref 42/103
4	1	-	Shackle (Bolted)	-	Fig 7, Ref 42/29A
53	1	-	Pinned Shackle c/w M25 * 90mm pin	-	NGC CC 43.24.515*
22	1	-	Landing Plate	-	Fig 53, Ref 42/21
7	1	-	190kN Ball Ended Eye Link	-	Fig 13, Ref 42/30
33	1	240546	Single Point Arcing Horn (Earth end) Approach Set c/w M16mm * 65mm Bolt	1091010492 sht1 item10	7 TA*
			Or		
34	1	240527	Single Point Arcing Horn (Earth end) Normal Set c/w M16 * 65mm Bolt	1091010492 sht1 item7	7 TB*
64			See Insulator Selection below		
12	1	-	190kN Socket Tongue	-	Fig 26, Ref 42/36
35	1	240584	Arcing Horn (Live end) – Use with Tongue	1091010496 sht1 Item 1	7 TC*

Insulator Selection

251519	132kV Tension Insulator Assembly for Single large Conductor 190kN, c/w ball ended eye link and socket tongue. Based on 9 x 178mm spacing with arcing horns set to 1000mm gap - Approach construction.	Composite version of 1091010428 sht13
251565	132kV Tension Insulator Assembly for Single large Conductor 190kN, c/w ball ended eye link and socket tongue. Based on 9 x 178mm spacing with arcing horns set to 1175mm gap - Non approach construction.	Composite version of 1091010428 sht13

All composite insulator assemblies are supplied inclusive of items 7, 33, 34, 12 and 35

Notes

* NGC and CEGB specifications may be no longer available in Northern PowerGrid database.

Replaces previous drawings
Y707L0703

Drawing to be replaced with a composite assembly drawing